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**A FURTHER CONTRIBUTION TO THE PALEONTOLOGY
OF TRINIDAD**

(Miocene Horizons)

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TO THE PUBLISHERS OF THE
BULLETINS OF AMERICAN PALEONTOLOGY
AND
PALÆONTOGRAPHICA AMERICANA

DEDICATED BY THE AUTHOR
WHO HAS WATCHED WITH ADMIRATION THE MAKING
OF THESE PUBLICATIONS
FROM THEIR INTREPID INCEPTION
TO THEIR PRESENT SUCCESS :
WORKS FOR THE ADVANCEMENT OF PALEONTOLOGY,
ORIGINAL AND FEARLESS

Anno amicitix tricesimo

CONTENTS

Stratigraphy and faunal relations.....	7
Description of species	19
Pelecypoda.....	19
Scaphopoda.....	182
Gastropoda.....	182
Explanation of plates.....	251

STRATIGRAPHIC AND FAUNAL RELATIONS

Professor Gilbert D. Harris, of Cornell University, has for the last five years been actively engaged in geological field work on the Island of Trinidad, in the West Indies.

During this period, Professor Harris has made very large collections of fossils from all over the Island, finding many entirely new fossiliferous localities.

These collections have been made under the auspices of the Trinidad Oil Development Company, of which Mr. Gerald A. Waring has been the Geologist constantly in the field. We are greatly indebted to Mr. Waring for facilitating in every way the collection of the fossils.

Mr. Waring is about to publish a report on the general geology of the Island, accompanied by a very beautiful and detailed geological map.

All the specimens described in the present Memoir are from Professor Harris' collections. At his request, I have taken the Miocene and Pliocene forms. The Eocene and Oligocene will be described by Professor Harris and will be accompanied by detailed stratigraphic notes.

Since the publication of my first "Contribution to the Paleontology of Trinidad," in 1912,* a number of us have been devoting ourselves to geological investigations in the Antilles and northern South America. And the pioneer stratigraphic conclusions of that Memoir are now given with their positions revised.

The Soldado Formation.—Migration of mollusca during the early Eocene was comparatively free, as the commingling of Brazilian and Alabamian species in the fauna of Bed No. 2 of Soldado Rock, in the Boca de Serpiente, clearly indicates. This fauna I described in 1912, and in *Science*, 1925, I proposed the name Soldado Formation, as the type

* Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 15, pp. 23-112, pls. 5-13, 1912.

of all basal Eocene deposits of northern South America and of the Antilles. In the American Journal of Science, 1925, I referred to this Soldado horizon early Eocene beds of Margarita and Taos Islands. The extension of this basal Eocene deposit has also been traced on the mainland of Trinidad. But the first discovery of beds of this age in that whole region was on Soldado.

The age of Bed No. 6, Soldado Rock, characterized by Foraminifera, is now thought to be Upper (Jacksonian) Eocene; and that of Bed No. 8 either uppermost Eocene or, less likely, basal Oligocene. Its fauna is not very decisive.

The San Fernando and Farallon Rock Eocene.—The curious Annelid worm, *Serpula clymenioides* Guppy, which forms a coiled tube imitating a helicoid shell; and the Crustacean, *Ranina porifera* Woodward, of which the carapaces are preserved as fossils, are figured in my 1912 Memoir. Both these striking forms are in the San Fernando and Farallon Rock beds, and the latter is also in strata on the Island of St. Bartholomew (St. Bart's) in the West Indies. Hence these three deposits are correlated together. Dr. Guppy called them Eocene, and Harris, Vaughan and Woodring now place them in the Jacksonian stage of that period.

The partial isolation of Trinidad Miocene Faunas.—The Caribbean Series (Wall and Sawkins, 1860) of schists and gneisses form a great mountain crescent extending from northern Trinidad, on the other side of the Boca del Draco, through the Peninsulas of Paria and Araya; thence, after the Barcelona break, they form the splendid heights of Caracas and Valencia; and, leaving the coast, swing in a wide curve through Trujillo, Mérida and Táchera.

This mountain barrier has had an important effect on the Miocene faunas of western Trinidad in checking their free migration and tending to isolate them. This explains the limited number of species common to the Trinidad and to the Isthmian, Dominican, and Jamaican Miocene faunas.

Miocene Stratigraphic Sequence in Trinidad.—The fol-

lowing terms may be used to indicate the general stratigraphic sequence of the Trinidad Miocene faunas described in the present Memoir:

- (1) Freeport-Todd's Road Miocene.
- (2) Springvale Miocene.
- (3) Brasso Miocene.
- (4) Manzanilla Miocene.
- (5) Machapoorie Miocene.
- (6) Tamana Micene.

(1) In the western part of central Trinidad, in the Department of Caroni, on the Freeport-Todd's Road at Ward's Shack, near the third mile post; and on the Gomez Estate, $1\frac{3}{4}$ miles southwest of Todd's Railway Station, are outcrops with *Arca patricia* Sowerby.

Under the description of this great *Arca* (the ancestor of *A. grandis*) a full discussion is given regarding its probable age. So that it is sufficient to note here that the stratigraphic indications in Trinidad, as in the Dominican Republic, point to a high horizon in the Miocene. Professor Harris is certain from field observations that the *Arca patricia* horizon on Todd's Road lies well above the Springvale Miocene.

(2) The Springvale beds are in west Central Trinidad, Department of Caroni, on a spur of the Montserrat Mountains, near Couva. This splendid collecting ground was first found by Dr. Guppy, in 1910, who then invited me to accompany him on a visit to the quarry; but, to my great regret, this was not possible. Dr. Guppy described a number of new species from Springvale. This, indeed, was his last paleontological work.

Professor Harris and Mr. Liddle recently made large collections from the Springvale beds, their fossils being herein described. This fauna is remarkable for the great size and exuberant vigor of the species. Conditions must have been ideal for molluscan growth. Giant members of the genera *Modiolus*, *Amusium*, *Marginella*, *Xancus*, *Ancilla*

and *Oliva* were present. But above all the most striking is the huge *Dosinia*—among fossil species comparable only with the great *Dosinia grandis* of the Zorritos Miocene of Peru; and with the living, Pacific shell, *D. ponderosa*.

On the east coast of the Island is a lignitic horizon equivalent stratigraphically to the Springvale. This lignitic, eastern phase affords a number of fossiliferous outcrops in the Department of St. Andrew, as at 600 feet north of Pointe Noir; $\frac{1}{4}$ mile north of Point Paloma; an unnamed headland north of Manzanilla, towards the mouth of the Oropuche River; and $\frac{1}{2}$ mile south of the mouth of the Oropuche. These four stations are thought by Professor Harris to be all about synchronous. For convenience, I have called them in this Memoir the Pointe Noir beds. Dr. Guppy also thought the outcrop at Pointe Noir equivalent to the western Savanetta beds of Caroni.

(3) Collections were made from Brasso Miocene beds at $\frac{1}{2}$ mile above Brasso Station, in the southeastern part of the Department of Caroni; Brasso Junction, 2 miles east of Brasso; E 24; top of the Brasso section No. 284; and the Junction of the Mayo and Couva main roads.

The Brasso Miocene is allied to the Manzanilla, of which it may, perhaps, be regarded as an upper member. This has been done by Mr. Waring. But I would rather keep them separate, and refer the Brasso to the Gatun and Gurabo formations of the Middle Miocene; and the Manzanilla to the Cercado formation of the Lower Miocene.

The Brasso shows its alliance with the Dominican Gurabo and to the Jamaican Bowden beds by the presence of the Middle Miocene species, *Arca inæquilateralis*, common to all three. To the Gatun beds of Costa Rica it is allied by the presence in both of *Arca pittieri* var. *narivana*.

(4) The original fossiliferous locality of the Manzanilla Miocene is Manzanilla Bay, on the eastern coast of Trinidad, in the southern part of the Department of St. Andrew. All of Dr. Guppy's Manzanilla fossils were

obtained from that vicinity.

Professor Harris has made extensive collections from many stations on both sides of Manzanilla Point and southward along the Bay. But, in addition, he has discovered new fossiliferous outcrops of the Manzanilla horizon—as at $3\frac{1}{2}$ miles south of Brasso; Brasso Venada Ravine; Brasso Creek; 11th mile post on Caparo Road; Guaico-Tamana Road, $7\frac{3}{4}$ and $8\frac{1}{2}$ miles on; bridge at Tamana road Junction; northeast corner of F. 16 in eastern Trinidad; and E 24.

By such a characteristic fossil as *Arca* (*Cunearca*) *flicata* Guppy, the Manzanilla horizon is traced across from Manzanilla Point on the east coast, through central E 24, southwest E 24 (west central part of the Island) to the 11th mile post on Caparo road. In a similar manner, *Arca trinitaria* Guppy is followed from the type locality on the west side of Manzanilla Point, and many stations on Manzanilla Bay to west central Trinidad (E 24), and northwestern H 3, and the 11th mile post on Caparo Road. Other Manzanilla species are also found in the Brasso Venada Ravine and in Brasso Creek, but in the Creek they are not *in situ*.

So that the Manzanilla has been found to extend, brokenly, from the northeast coast southwest to the vicinity of Brasso.

Dr. Guppy's most important publication relating to the Manzanilla deposits is in the Quarterly Journal of the Geological Society, London, vol. 22, pp. 570-590, pl. 26, 1866. In this he referred these beds to the Lower Miocene; in 1890, he called them Eocene, but in 1913, said again that they might be Lower Miocene.

That they are Miocene is certain for associated with the characteristic Manzanilla species described by Guppy, we have found familiar Dominican Miocene species, as *Drillia henekeni*, *D. consors*, *Mitra longa*, *Mitra henekeni*,

Turris albida, and others.

(5) Collections of Machapoorie Miocene were made from Machapoorie quarry; Poole River (East Central Trinidad); Fossil Ravine (Central Trinidad); Eastern E 24; Guaico-Tamana Road, 13th mile post; Brasso-Tamana road near the 4½ mile post; Brasso Valley in an outcrop beneath the Manzanilla Miocene beds exposed there. It is probable that Dr. Guppy's Corosal *Cadulus* ("*Ditrupa*") bed belongs also in the Machapoorie.

The fauna of the Machapoorie is in the form of casts. The most striking and characteristic forms are a high, narrow *Cardium* and the great *Pholadomya walli*. The latter is broken, but I have seen magnificent specimens, evidently the same species, as large as a man's fist, from Venezuela.

The stratigraphic position of the Machapoorie is proved by the Brasso Valley exposure where it is seen underlying the Manzanilla.

(6) Fossils of the Tamana horizon were obtained from Eastern E 25, Central E 25 (both in the northwestern part of the Department of Nariva); Mendozo quarry; Central E 24; and 8½ miles on the Tabaquite Road, the last two localities being in the southeastern part of the Department of Caroni, and the last station very near the Tabaquite oil fields. The Tamana fossils are all casts.

The Godineau River Miocene.—A mile west of the Godineau River, on the shore of the Gulf of Paria, about midway between San Fernando and La Brea, is a decayed, white limestone containing internal molds of large molluscs. These were first discovered by Dr. A. C. Veatch, and in my 1912 Memoir, I thought the molds probably of fresh water species and of *Unio*-like form. Later Miss Van Winkle made very careful studies of the traces of hinge structure of certain molds and concluded marine forms were present, as *Thyasira*, *Solariella* and a new genus *Pleurophopsis* (see Bulletin American Paleontology, No. 33, pp. 23-27, 1919). Subsequently Professor Harris made further collections

from the Godineau River beds and will later publish his conclusions.

Apparently these beds contain a mixed fauna of fresh-water and marine origin, and presumably were deposited where a river entered the sea. They appear to be about Middle Miocene in age.

A similar intermingling of river and sea shells is found in the Oligocene (?) deposits of the Angela Elmira asphalt mine, near Bejucal, Cuba, where *Unio*, *Hemisinus*, *Cypræa*, *Solemya* and other genera are present.

Remarks on the Oligocene and Miocene of the Antilles.—In my 1912 Trinidad Memoir (Journal Academy Natural Science Philadelphia, 2nd ser., vol. 15, pp. 23-112, pls. 5-13), I followed the American usage, established by Dr. Dall in 1896 (Proceedings U. S. National Museum, vol. 19, p. 303), and 1903 (Transactions Wagner Institute Science, vol. 3, part 6), of calling the Antillean beds of Bowden and of Gatun age, and the Chipola beds of Florida, Oligocene. The Americans then called all Antillean beds above the Eocene and below the Pliocene Oligocene, and the English called them all Miocene.

But in 1917, I differentiated the Oligocene and Miocene in the Antilles (Bulletin American Paleontology, No. 30 and Correlation at close) and divided the Dominican Miocene into Middle and Lower, the former represented by the Gurabo and the latter by the Cercado formations.

In 1917, I also put the Gatun beds with *Sconsia lævigata* in the Middle Miocene, along with the Gurabo, because that shell is very characteristic of those beds. This paleontological conclusion was later proved stratigraphically when in 1922, Mr. Olsson found that the Uscari beds of Costa Rica belong in Lower Miocene, beneath the Middle Miocene of the *Sconsia* Gatun beds. He also differentiated a higher, Upper Miocene, phase of the Gatun. (See Bulletin American Paleontology, No. 39, 1922.)

In studying the Tertiary fossils of Porto Rico, collected

by Dr. Chester A. Reeds, Curator Department of Geology, American Museum of Natural History, I correlated the Quebradillas limestone as Lower to Middle Miocene, because while it had the Bowden and Dominican faunas, it was not decisively with the Gurabo or with the Cercado, but had forms common to both. (See American Journal of Science, vol. 48, pp. 212, 214, 1919; also Scientific Survey Porto Rico, vol. 3, part 1, pp. 3-5, and Correlation Table, 1920). Mr. Bela Hubbard later referred the Quebradillas limestone to the Upper Oligocene (Survey Porto Rico, vol. 3, part 2, 1921; also Science, new series, vol. 51, No. 1320, p. 5, 1920). I am very sure that this is erroneous, and think that Mr. Hubbard was deceived by some internal molds.

I am certain that the Lower Miocene is the basal limit of the Quebradillas and it may very likely be found to go with the Bowden, in Middle Miocene.

The Miocene Flora of Trinidad.—Dr. Hollick has described (Bull. New York Botanic Garden, vol. 12, No. 45, 1924) a number of Angiosperms from the porcellanite quarry of Siparia, Trinidad. This is situated on the southern coast of Trinidad, in the southeastern part of the Department of St. Patrick, and the quarry is about 5 miles inland. Apparently Dr. Hollick does not give the horizon, but Professor Harris, who has been on the field, says it is probably Miocene. In the Siparia palæoflora Dr. Hollick found a leaf of *Musa* or *Musophyllum* that he named *trinintense*, which is of special interest as throwing light on the original habitat of the banana (*Musa sapientum*), of which the Siparia species seems an ancestral form, and suggests a New World nativity of this important genus. There were also a number of species of the fig genus (*Ficus*); *Cassia sipariensis*; *Clusia vera*; and the myrtle, *Myrcia pseudoros-trata*. In the Bluff North of Moruga, south Trinidad, are leaves of *Inga pseudonobilis*.

Dr. Hollick writes (page 321, *loc. cit.*): "We may infer, therefore, that the West Indian Tertiary flora, in its generic

elements, was identical with the existing flora of the same region, and that a majority of its specific elements were so closely similar to certain existing species of the islands and the adjacent mainland of North America, Mexico, Central America, and South America that it is almost impossible to differentiate between them. . . . Evidently the flora of the region has undergone very little change or modification during the entire period of time that has elapsed since the Tertiary flora flourished there, and this indicates, conclusively, that climatic conditions must have been uniform throughout the same period and practically the same as those that now obtain in the region."

Affinities and correlation of the Trinidad Palæofaunas.—In a recent article on "Venezuelan Stratigraphy" in the American Journal of Science, I correlated certain Venezuela horizons with those of Trinidad. Thus in the Cretaceous, the Cenomanian Rudistid fauna of Pointe-à-Pierre (described in 1922 by Professor Harris), I correlated with the Rudistid limestone of Cumanocoa and between that town and El Pilar, in the State of Sucre, Eastern Venezuela. With the Basal Eocene Soldado formation of Soldado Rock, Bed No. 2, I placed the Margarita and Taos Island Eocene beds. The Upper Eocene *Lepidocyclina* beds of Bontour Point go with those of Rio San Pedro, in Trujillo, and the Las Palmas beds, Lake Maracaibo, and with the Farallon Rock and San Fernando, Trinidad, *Serpula clymenioides* and *Ranina porifera* beds; and with the foraminiferal horizon, Bed No. 6, of my 1912 Memoir.

The Miocene mollusca of Trinidad show a relationship to synchronous faunas of Venezuela, Central America, and the Antilles, but the number of species in common is rather surprisingly limited. As already noted, this is to be explained by the presence of the partial mountain barrier inducing isolation and checking free intermigration.

Judging from faunal affinities, the following grouping of the Trinidad Miocene fossiliferous beds and their equivalency is suggested:

UPPER MIOCENE—

1. Freeport-Todd's Road and Gomez Estate beds with *Arca patricia*; Union Estate, Brighton, *Ostrea* beds; Brighton southern road south of Pitch Lake, fossiliferous ferruginous marls.

Equivalent to the Yabelito beds with *Arca patricia*, State of Falcon, Venezuela; to the Botanic Station beds of Tobago Island with *Arca patricia*; and to the Cerros de Sal A. *patricia* horizon of the Dominican Republic.

2. The Springvale and Savanetta beds of western Trinidad and the equivalent lignitic phase represented by the Pointe Noir beds of eastern Trinidad are decidedly lower members of the Upper Miocene than the *Arca patricia* horizon. Distinctive Springvale fossils are *Dosinia titan*, resembling *D. grandis* of the Zorritos Miocene of Peru, and *Modiolus waringi*.

3. Lower Springvale blue clays are seen west of Brasso Junction, stratigraphically 75–100 feet above the limestone forming the top of the Brasso series. This change in sedimentation was accompanied by a marked change in the *Turritella* fauna. *Turritella altilira* var. *tornata* and its mutations, exceedingly abundant in the Machapoorie, Manzanilla and Brasso, suddenly declines, becomes rare, and vanishes after the Springvale; while *T. planigyrate* gains the ascendancy, prevails in the Springvale and leaves a modern descendant, *T. variabilis* var. *meta*, living on the Trinidad shores.

MIDDLE MIOCENE—

Brasso Miocene with *Arca inæquilateralis* and *A. pittieri* var. *narivana*.

Equivalent to the Gurabo formation, Dominican Republic; Bowden beds, Jamaica; the Gatun of the Isthmus and Costa Rica; the Cumana, Venezuela, beds with *Arca cumanensis* and *A. tolepeia*; certain fossil-

ferous beds of eastern Zulia in western Venezuela; and to the Cartagena beds of Colombia.

The Godineau River beds, southwest of San Fernando, Trinidad, with a mixed freshwater and brackish fauna, including *Unio*-ike molds and *Thyasira*, may also be placed in Middle Miocene, but the evidence of the fauna is inconclusive.

LOWER MIOCENE—

1. The Manzanilla Miocene affords many species peculiar to itself; but in addition contains many characteristic Dominican forms which indicate alliance with the Cercado formation, Dominican Republic; and to the Los Quiros beds, western Venezuela, in the eastern part of the State of Zulia.

2. The Machapoorie Miocene beds are shown to be stratigraphically lower than the Manzanilla in a Brasso Valley section where they are seen overlying the latter.

3. The Tamana Miocene constitutes the basal member of the Miocene series of Trinidad.

Pliocene Stratigraphic Sequence in Trinidad.—The following sequence and equivalency of Pliocene deposits in the eastern and western parts of Trinidad is suggested:

PLIOCENE OF TRINIDAD

UPPER PLIOCENE

Western

Eastern

Asphaltic marl near Brigh-	Matura Bay deposits.
ton pier. Fauna marine.	Fauna marine.

LOWER PLIOCENE

Cedros Point beds, Esperanza Bay, in southwestern Trinidad; and Pointe Cou-	Comparo Road beds, near Sangre Grande, northeastern Trinidad. Freshwater
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baril beds near Brighton. Both deposits with freshwater faunas.

fauna. Probably equivalent to the Pliocene-Late Miocene, Pebas beds, of the Upper Amazon.

Hemisinus Faunas of the Antillean Tertiary.—The presence of various species of the river shell, *Hemisinus*, in Tertiary deposits of Antigua, Cuba, Dominican Republic and Trinidad, is of interest as throwing light on ancient connections of the Antilles with the main land; and as indicative of the presence of Tertiary Island rivers of considerable permanency. There are four species in the Antiguan Oligocene, and two in the Bejucal beds of Cuba. *Hemisinus truncatus* (*Ectracheliza truncata* Gabb) is the large Dominican representative of this genus in Tertiary time. All these species like the *Hemisinus* of Comparo Road, Trinidad, show strong affinities with Brazilian and other South American living river species, and suggest a former land connection of the Antilles with South America, the ancestral home of *Hemisinus*.

The Hyria Fauna of Cedros Point.—From southwestern Trinidad we have a freshwater mussel of the interesting genus *Hyria*, characteristic of the Neo-tropical Province, and represented by only a few species. The Cedros Point shell is evidently ancestral to the genotype, *Hyria corrugata*.

With the *Hyria* is a *Corbicula* identical with that of Comparo Road, suggesting the equivalency of these deposits.

It is quite probable that these Lower Pliocene freshwater faunas of Trinidad were living at about the time that the Pebas beds of the Upper Amazon were forming—when the mouth of the Amazon was several thousand miles to the westward of its present position, and the now majestic river was short and comparatively insignificant.



Fetish-like clay concretions from the Turonian of Venezuela. Collected by the author on the Hurupu Trail near Guanoco. Similar ones were placed by the Venezuelans on the arms of a votive cross in the forest wilderness.

DESCRIPTIONS OF SPECIES

MOLLUSCA

CLASS PELECYPODA

Genus *NUCULA* Lamarck

Subgenus *ACILA* H. and A. Adams

Nucula (Acila) schomburgki Forbes

Nucula schomburgki Forbes, 1846, In Schomburgk's History of Barbados, p. 565.

Nucula schomburgki Guppy, 1867, Geol. Mag., London, pp. 497, 498, 500, fig. 5.

Nucula schomburgki Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 163; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 42.

Nucula schomburgki Guppy, 1874, Geol. Mag., p. 442.

Nucula schomburgki Guppy, 1878, Proc. Sci. Assoc. Trinidad, vol. 2, p. 170, pl. 7, fig. 10; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 91, pl. 5, fig. 10.

Nucula schomburgki Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, pt. 4, p. 573.

This species is at once recognized by its divaricating sculpture, characteristic of the subgenus *Acila*. The radials divaricate along an oblique line passing across the center of

the disc from the beak to the base. The shell is thick and nacreous, and the lunule impressed but not circumscribed. Examples vary considerably in length and altitude but Guppy's figure represents the shell as 14 x 9 mm.

Sir Robert Schomburgk first discovered this species on the Island of Barbados, and it was described by Prof. Forbes in 1846. It was rediscovered by Dr. Guppy in 1867 in a greenish-gray shale at San Fernando, Trinidad.

It is entirely unlike in both form and sculpture Gabb's *Acila tuberculata* from the Dominican Miocene.

All living members of the subgenus *Acila* are Pacific in their distribution. The last inhabitant of Atlantic waters was the Pliocene *Acila cobboldiæ* of the British Crag. To this and to the recent Pacific species, *A. divaricata*, the Trinidad and Barbados shell is most closely allied. The sculpture is also somewhat as in *Acila cordata* Dall from the Miocene of Oregon.

Locality.—San Fernando, Trinidad (Guppy).

Horizon.—Dr. Guppy thought the age Eocene. It is probably Upper Eocene, about equivalent to the Jacksonian of the Gulf States. The horizon is, however, somewhat doubtful, as the stratigraphy at San Fernando is most complex and involved.

Subgenus *NUCULA*, *sensu stricto*

Nucula baccata Guppy

Pl. 12, Fig. 5

Nucula baccata Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, pp. 163, 174; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, pp. 42, 53.

Nucula baccata Guppy, 1874, Geol. Mag., London, 2d ser., vol. 1, p. 443, pl. 18, fig. 7.

Nucula baccata Guppy, Proc. Sci. Assoc. Trinidad, vol. 2, p. 171, pl. 7, fig. 12; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 92, pl. 5, fig. 12.

Nucula baccata Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 577.

Shell small, sub-ovate, oblique, posteriorly slightly produced, anterior and posterior ends angulate; surface ornamented with fine concentric lines decussated by delicate

radial striæ, interior pearl-shining; hinge-teeth divided by a very oblique pit; inner margins of shell finely crenulate. Guppy's specimen measured 7 mm. in length and 5.5 in height. Ours is also 7 x 5. Type locality, Matura.

A charming little shell, of the *Nucula obliqua* and *similis* group. A striking feature is its marked angularity anteriorly and posteriorly.

Locality.—Matura.

Horizon.—Upper Pliocene.

***Nucula vieta* Guppy**

Nucula vieta Guppy, 1867, Proc. Sci. Assoc. Trinidad, pp. 163, 174; Harris' Reprint, 1924, Bull. Amer. Paleont., No. 35, pp. 42, 53.

Nucula vieta Guppy, 1874, Geol. Mag., London, p. 443, pl. 18, fig. 8.

Nucula vieta Guppy, 1878, Proc. Sci. Assoc. Trinidad, p. 171, pl. 7, fig. 11; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 92, pl. 5, fig. 11.

Shell very small, obliquely-trigonal, with concentric rounded ribs, posterior side slightly produced, very oblique; anterior side short, with few and small teeth; posterior teeth straight. Margins dentate. The largest specimens were 3.5 mm. in height, and 3 in length.

Locality.—Matura, Trinidad.

Horizon.—Upper Pliocene.

***Nucula crosbyana* Guppy**

Nucula crosbyana Guppy, 1878, Proc. Sci. Assoc. Trinidad, vol. 2, p. 170, pl. 7, figs. 3, 3a; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 91, pl. 5, figs. 3, 3a.

Oval-elliptical, subequilateral, thin, smooth, shining, faintly marked with concentric riblets; ends rounded, beaks small, hinge teeth about 12 in front of the ligamental pit and 15 behind it. Length 16, height 8.5 mm.

Locality.—Gulf of Paria, Trinidad. (Guppy.)

Horizon.—Recent.

Genus *LEDA* Schumacher

Dr. Guppy took a special interest in the *Ledidæ* and

described a number of Miocene and Recent species. The latter are brought together here for the sake of completeness, but I have not seen the specimens, the figures are inadequate, and I do not feel certain that in all cases his recent species are valid. It is possible that some may fall in synonymy.

***Leda illecta* Guppy**

Pl. 12, Fig. 2

Leda illecta Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 174; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 53.

Leda illecta Guppy, 1874, Geol. Mag., p. 442.

Leda illecta Guppy, 1878, Proc. Sci. Assoc. Trinidad, vol. 2, p. 173, pl. 7, fig. 5; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 94, pl. 5, fig. 5.

Leda illecta Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 579.

Shell small, inflated, appearing smooth, but showing under a lens very fine, close and delicate concentric striations; posterior end produced into a rostrum which is slightly curved upwards, giving, with the tumid form, a somewhat pear-shaped aspect to the shell. Length of type 10, height 6 mm.

We have a large number of specimens from the type locality and its vicinity. The shells vary in length from 3.5 to 10 or 15 mm., the latter being 7 mm. in height and unusually large.

This species resembles *Leda eburnea* Sowerby, but the posterior end is longer and more curved.

Locality.—Manzanilla Bay at many collecting stations.

Horizon.—Manzanilla Miocene.

***Leda guppyi* Dall**

Pl. 12, Fig. 3

Cercomya ledæformis Guppy, 1866, Quart. Jour. Geol. Soc., London, vol. 22, p. 581, pl. 26, fig. 1.

Cercomya ledæformis Guppy, 1867, Proc. Sci. Assoc. Trinidad, p. 161; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 40.

Cercomya ledæformis Guppy, 1874, Geol. Mag., London, p. 441.

Leda guppyi Dall, 1896, Proc. U. S. Nat. Mus., vol. 19, No. 1110, p. 239.

Leda guppyi Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 579.

An elongate, inequilateral, thin species, with fine con-

centric, raised lines which at the posterior carination may rise into small points. Anterior end rounded, posterior rostrate, dorsal margin concave posteriorly. Length of type 24, altitude 9 mm.

The hinge of the type was concealed which misled Dr. Guppy as to the genus, and the shell was renamed by Dr. Dall.

Our shells measure 23 x 7.5 and 24 x 9 mm. In one example over 20 of the anterior series of teeth extend beyond the matrix and are seen to be strong and long for this delicate, much flattened shell. The posterior area bears two carinæ, the uppermost bordering the dorsal area.

Locality.—Manzanilla (type locality) and vicinity.

Horizon.—Manzanilla Miocene.

***Leda peltella* Dall**

Leda acuta Gabb, 1873, Trans. Amer. Philos. Soc., vol. 15, p. 255.

Not *Leda acuta* Conrad, 1831, Amer. Marine Conch., p. 32, pl. 6, fig. 1. Not *acuta* Sowerby, 1837.

Leda acuta Guppy, 1878, Proc. Sci. Assoc. Trinidad, vol. 2, p. 172, pl. 7, fig. 8; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 93, pl. 5, fig. 8.

Leda peltella Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, pt. 4, p. 579, pl. 32, fig. 5.

Leda acuta Guppy, 1912, Agric. Soc. Trinidad and Tobago, Paper No. 520, p. 4; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 187.

Leda peltella Maury, 1917, Bull. Amer. Paleont., No. 29, p. 161, pl. 26, fig. 9.

A short, high species, with nearly central beaks, a very convexly rounded basal margin, short, sharp posterior end; and fine concentric sculpture. I have thousands from the Dominican Miocene. They run from about 6–8 mm. in length. Also found at Bowden, Jamaica, and Dr. Guppy recorded it from Trinidad.

The species was renamed by Dall because *acuta* is preoccupied by Conrad's Recent to Pleistocene species, living on both our Atlantic and Pacific coasts.

Locality. — Corosal Road *Cadulus* bed, Trinidad (Guppy coll.).

Horizon. — Perhaps equivalent to the Machapoorie Miocene.

***Leda packeri* Forbes**

- Leda packeri* Forbes, 1846, In Schomburgk's Hist. Barbados, p. 565.
Leda incognita Guppy, 1867, Geol. Mag., pp. 500, 501, fig. 1.
Leda incognita Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 163;
 Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 42.
Leda packeri Guppy, 1878, Proc. Sci. Assoc. Trinidad, vol. 2, p. 172,
 pl. 7, fig. 9; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35,
 p. 93, pl. 5, fig. 9.
Leda packeri Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 579.

Ovate, with rounded concentric ribs; rostrated posteriorly. Lunule and posterior dorsal area broad, distinct, circumscribed by the keels which run from the umbones to the extremities. Length 8.5, height 5 mm.

Dr. Guppy's *Leda incognita* was based on on a single specimen from San Fernando. In 1878, he thought this specifically identical with Forbes' Barbados species, *L. packeri*.

Localities.—Barbados and San Fernando, Trinidad (Guppy).

Horizon.—Thought by Guppy to be Lower Miocene.

***Leda montserratensis*, n. sp.**

Pl. 12, Fig. 1

Shell transversely subelliptical, greatly compressed, subequilateral, the low and inconspicuous beak being only a little nearer the anterior than the posterior end; dorsal area defined by a linear ridge. Surface of shell marked with occasional, inconspicuous, concentric lines indicating slower growth stages, and sculptured with a far more noticeable series of close, regularly spaced transverse lines which are not parallel to the concentric growth lines but are subparallel to the hinge, cutting across the lower face of the valve and terminating one by one at the basal posterior margin. This feature is very marked and recalls the striations across the face of the disc in the Jacksonian shell, *Leda multilineata* Conrad. The hinge line is very straight. Hinge

teeth concealed by matrix. Length of valve 18, altitude 7 mm.

Locality.—In blue shaly clay, $\frac{1}{2}$ mile above Brasso Station, No. 302.

Horizon.—Lower Springvale Miocene.

Leda clara Guppy

Leda clara Guppy, 1873, Proc. Sci. Assoc. Trinidad, vol. 2, p. 87; Harris' Reprint, 1921, Bull. Amer., Paleont., No. 35, p. 71.

Leda clara Guppy, 1874, Geol. Mag., p. 442, pl. 17, figs. 1, 1a; Idem, 1875, p. 42.

Leda clara Guppy, 1878, Proc. Sci. Assoc. Trinidad, vol. 2, p. 172, pl. 7, fig. 4; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 93, pl. 5, fig. 4.

Leda clara Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 579.

This species is nearly equilateral, somewhat rostrated, disc smooth and shining. A few close, regular, concentric riblets are present near the indistinct anterior sulcation. Lunule narrow, weakly defined. Beaks prominent. Posterior carina obscure. Length of shell 12, height 6, diameter 4 mm.

The shell is larger and less acutely rostrate than *L. vitrea*. In general shape Guppy compared it with *sapotilla* Gould. But that is fully twice as large, a New England shell, and a *Yoldia*. *Leda clara* has not been reported from Trinidad.

Locality.—Bowden, Jamaica.

Horizon.—Middle Miocene.

Leda indigena Dall

Leda bisulcata Guppy, 1867, Geol. Mag., London, p. 500, fig. 2. Not *Leda bisulcata* Meek, 1861.

Leda bisulcata Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 163; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 42.

Leda bisulcata Guppy, 1874, Geol. Mag., p. 442.

Leda bisulcata Guppy, 1878, Proc. Sci. Assoc. Trinidad, vol. 2, p. 173, pl. 7, fig. 7; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 94, pl. 5, fig. 7.

Leda indigena Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 579.

Dr. Dall renamed this species, because *bisulcata* had

been preoccupied by Meek six years before Guppy named his shell.

This species is about the size of *L. peltella*, attaining a length of 8 or 9 mm., but the posterior end is more produced, and the valve is marked by a posterior ridge and an anterior furrow—the anterior sulcation resembling that in d'Orbigny's figure of his *L. jamaicensis*. The concentric riblets are much finer than in *peltella*. Teeth very prominent.

Locality.—Bowden, Jamaica.

Horizon.—Middle Miocene.

Leda perlepida Guppy

Pl. 12, Fig. 4

Leda perlepida Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, pp. 163, 173; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, pp. 42, 52.

Leda perlepida Guppy, 1873, Proc. Sci. Assoc. Trinidad, vol. 2, p. 87; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 71.

Leda perlepida Guppy, 1874, Geol. Mag., London, p. 442, pl. 18, fig. 9.

Leda perlepida Guppy, 1878, Proc. Sci. Assoc. Trinidad, vol. 2, p. 172; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 93.

Leda perlepida Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 579.

Original description.—"Transversely oval, subinequilateral, moderately convex, with numerous fine, concentric striae and occasional deeper and wider concentric furrows; posterior end acutely rostrate; lunule none; dorsal area elongate-lanceolate, longitudinally striate; hinge-teeth numerous, chevron-shaped, widely interrupted beneath the umbo by a large hinge-pit."

The shell thus described was from the Matura Pliocene. But in 1878 Dr. Guppy placed his *perlepida* in the synonymy of *vitrea* d'Orbigny, of the recent fauna.

But we have from Matura a charming little shell, well-meriting the name *perlepida*. The surface is very delicately, microscopically striate, with three or four conspicuous deep, wide furrows and corresponding rounded ridges on the face of the valve. This specimen is 3 mm. long and 2 mm. high. Guppy's figure of *perlepida* measures 8 x 5 mm., so ours is

a young shell, although his figure may be slightly enlarged.

This species is readily distinguished from *L. vitrea* by its furrowed surface.

Locality.—Matura.

Horizon.—Upper Pliocene.

***Leda vitrea* d'Orbigny**

Leda vitrea d'Orbigny, 1845, In de la Sagra's Historia Fisica, Politica y Natural de la Isla de Cuba, pt. 2, vol. 5, *Moluscos*, p. 310, Atlas, pl. 26, figs. 27-29.

Leda vitrea Guppy, 1878, Proc. Sci. Assoc. Trinidad, vol. 2, pp. 169, 192, pl. 7, fig. 6; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, pp. 90, 93, pl. 5, fig. 6.

Leda vitrea Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 579.

Shell ovate, moderately inflated, shining white and glassy, surface finely, concentrically ribbed; anterior end rounded; posterior produced, carinated, rostrate. Length of type 6 mm. D'Orbigny's specimens were from Martinique and Santo Domingo.

This species shows no broad concentric furrows which are such a marked feature in *L. perlepada*.

Dr. Dall in 1898, united *L. milleri* Gabb with d'Orbigny's *vitrea*. And in 1878, Dr. Guppy placed his *perlepada* in the synonymy of *vitrea*, but they differ very markedly in sculpture and appear to me entirely distinct species.

Locality.—Gulf of Paria, Trinidad. Dredged. (Guppy coll.)

Horizon.—Recent.

***Leda jamaicensis* d'Orbigny**

Leda jamaicensis d'Orbigny, 1845, In de la Sagra's Historia Pol. y Nat. Isla de Cuba, vol. 5, *Moluscos*, p. 310, pl. 26, figs. 30-32.

Leda jamaicensis Guppy, 1878, Proc. Sci. Assoc. Trinidad, vol. 2, pp. 169, 173; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 90, 94.

A small, ovate species, concentrically striate, short and rounded anteriorly, and bearing an anterior radial sulcation; posteriorly produced, carinated and pointed. The type

was somewhat over 3 mm. in length, and was found in the Antilles.

In 1920 (Bull. Amer. Paleont., No. 34, p. 6) I followed Dr. Dall in uniting this species with *Leda acuta* Conrad (not *acuta* Gabb, which is *peltella* Dall). But Conrad's species (Amer. Mar. Conch., p. 32, pl. 6, fig. 1, 1831; Foss. Medial Tert., p. 57, pl. 30, fig. 2, 1845) is more rostrate and more recurved posteriorly than d'Orbigny's shell, and the latter has a strong anterior sulcation, which our specimens of *acuta* do not show.

Guppy's Trinidad shells did not exactly correspond to d'Orbigny's type but he thought them referable to this species.

Locality.—Gulf of Paria, Trinidad. Dredged by Dr. Guppy.

Horizon.—Recent.

***Leda egregia* Guppy**

Leda egregia Guppy, 1878, Proc. Sci. Assoc. Trinidad, vol. 2, p. 174, pl. 7, figs. 1, 2; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 95, pl. 5, figs. 1, 2.

Large, lanceolate, narrow, ivory-shining, inequilateral, much rostrated; ribs crowded, concentric, somewhat lamellar; almost obsolete on the center of the valve. Hinge teeth in two series separated by a broad triangular pit, immediately beneath the small umbo; posterior dorsal area with two ridges; epidermis dark. Length 25–40, height 8–13 mm.

Intermediate between *tellinoides* Sowerby and *patagonica* d'Orbigny.

This fine species was dredged.

Locality.—Gulf of Paria, Trinidad (Guppy).

Horizon.—Recent.

***Leda* cf. *patagonica* d'Orbigny**

Leda patagonica d'Orbigny, 1843, Voyage l'Amér. Mérid., p. 544, Atlas, pl. 82, figs. 1–3.

Leda patagonica Guppy, 1878, Proc. Sci. Assoc. Trinidad, vol. 2, pp. 169, 174; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, pp. 90, 95.

Shell large, very long, narrow, greatly compressed, white, subequilateral, more or less concentrically ridged; posterior end produced, rostrate, recurved; posterior dorsal region excavated.

D'Orbigny's type was from Bahia de San Blas, Argentina.

Fide Dr. Guppy, two valves of this species were dredged off Trinidad.

They were, however, larger, 49 mm. in length and 16 in height. It seems probable, in view of the distribution, that they were related to the Patagonian species rather than identical with it.

Locality.—Gulf of Paria, Trinidad (Guppy).

Horizon.—Recent.

Genus *GLYCYMERIS* Da Costa

Glycymeris jamaicensis Dall

Pl. 18, Fig. 5

Pectunculus pennaceus Guppy, 1866, Quart. Jour. Geol. Soc., London, vol. 22, p. 293. Not of Lamarck.

Axinea pennacea Gabb, 1873, Trans. Amer. Phil. Soc., vol. 15, p. 255.

Petunculus decussatus Guppy, 1873, Quart. Jour. Geol. Soc., vol. 32, p. 532. Not of Hanley.

Glycymeris jamaicensis Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, pp. 608, 1586.

Glycymeris jamaicensis Maury, 1917, Bull. Amer. Paleont., No. 29, p. 181, pl. 26, fig. 13.

Glycymeris jamaicensis Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 178, pl. 19, figs. 3, 4.

Shell of medium size, moderately convex, subcircular, but with the posterior basal margin angulate; surface with fine, even, radiating striæ, impressed at intervals giving the effect of obsolete ribs; beaks low, plump, central. Altitude of type 33, length 35, diameter 22 mm. The Trinidad specimen is small, measuring 23 x 24 mm.

Several related species of the Antillean recent fauna have persisted from the Miocene up, but *jamaicensis* became

extinct. The type was from Bowden. We have the shell from Santo Domingo, and it attains a very large size in the Costa Rican Miocene.

Locality.—Two miles southwest of Machapoorie quarry, Trinidad.

Horizon.—Machapoorie Miocene.

***Glycymeris jamaicensis* var. *machapoorensis*, n. var.** Pl. 18, Fig. 15

We have several specimens which differ in some respects from *G. jamaicensis* to which they are, however, very closely related. The main difference appears in details of sculpture. In *jamaicensis* there are five or six radial striæ, then two or three depressed lines, while in the adult sculpture of these specimens there are three or four striæ followed by a single depressed line, so that the groups are narrower and the impressed lines single. The largest shell is 38 in height, estimated length 40, semidiameter 15 mm.

Locality.—Machapoorie quarry.

Horizon.—Machapoorie Miocene.

***Glycymeris decussata* Linnæus**

Pl. 18, Fig. 14

Arca decussata Linnæus, 1758, Syst. Nat., ed. X, p. 694.

Pectunculus pennaceus Lamrack, 1819, Anim. sans Vert., vol. 6, p. 51.

Pectunculus pennaceus Reeve, 1843, Conch. Icon., *Pectunculus*, pl. 5, fig. 24.

Glycymeris pennacea Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 608.

Pectunculus decussatus Linnæus, Lamy, 1911, Journ. de Conchyliologie, vol. 59, p. 119, pl. 3, fig. 7.

Glycymeris decussata Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 180, pl. 19, figs. 5, 6.

We have a crushed specimen apparently referable to this species. Normally it is convex and differs from *G. jamaicensis* in being inequilateral, the beaks situated a little behind the center with the ligamental area entirely in front of the beaks. The sculpture is of many, rather coarse, radiating threads, single proximally, but distally divided into three or more. A typical shell measures length 33, height 32, diameter 20 mm. Our crushed shell is 30 x 29 mm.

This species is more generally called by the later name, *pennacea* Lamarck. It is rare, but extends back into Miocene time and is now living in the West Indies.

Locality.—Machapoorie quarry.

Horizon.—Machapoorie Miocene.

Glycymeris canalis Brown and Pilsbry

Pl. 18, Figs. 3, 4

Glycymeris canalis Brown and Pilsbry, 1911, Proc. Acad. Nat. Sci. Phila., vol. 63, p. 364, pl. 28, fig. 10.

Glycymeris canalis Olsson (*pro parte*), 1922, Bull. Amer. Paleont., No. 39, p. 177, fig. 2.

We have several specimens from Trinidad closely resembling the illustration of the type of *canalis*. They are of the same form and size and have the same number of ribs. The shell is rather small, subcircular, a trifle higher than long, with 33 strong, round ribs and narrow interspaces, marked with close, concentric striæ. Length 14.5, altitude 15, semidiameter 4.5 mm.

This species, by the development of secondary riblets, may grade into *trilobocosta*. The figure of the type shows the secondary riblets arising distally. The same is true in our specimens but the intercalated riblets are few and inconspicuous.

G. canalis is common in the Gatun stage of the Canal Zone and of Costa Rica.

Localities.—Poole River (East Central Trinidad); Fossil Ravine (Central Trinidad); Machapoorie quarry; Brasso Creek.

Horizon.—All Machapoorie Miocene except Brasso Creek, where the fauna is mixed and doubtfully Manzanilla Miocene.

***Glycymeris canalis* var. *trinitensis*, n. var.**

Pl. 18, Fig. 2

Shell rather small, subcircular, somewhat plump, beak a little prominent; surface sculptured with 44 undivided, subequal ribs. Length 18, altitude 16, semidiameter 5 mm.

This differs from typical *canalis* in the much more

numerous ribs, the central ones being slightly disposed to be more sharply edged.

Locality.—Machapoorie quarry.

Horizon.—Machapoorie Miocene.

Glycymeris trilobica Pilsbry and Brown

Pl. 18, Fig. 11

Glycymeris trilobica Pilsbry and Brown, 1918, Proc. Acad. Nat. Sci. Phila., vol. 69, p. 39, pl. 6, fig. 5.

Glycymeris canalis var. *trilobica* Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 177, figs. 4, 5.

The type, from the Gatun of Cartagena, Colombia, was an immature shell, only 14.5 in length and 14.6 in height, semidiameter 4 mm., with about 32 ribs. Our Trinidad specimens, like Mr. Olsson's from Costa Rica, are larger, with fewer ribs. The ribs number about 25 and are simple proximally but distally a secondary riblet arises on either side of the primary, making a pretty, tripartite pattern with the central rib of each group the highest. Interspaces very narrow, linear. Length 22, altitude 23, diameter 8.5 mm.

This form when typical is well marked, but it is so protean in its variation that Mr. Olsson, who had a beautiful set from Costa Rica, grouped all under *G. canalis*. But in Trinidad, as it is usually tripartite and is abundant and widespread, it seems appropriate to recognize it as either specific or varietal.

Localities.—(1) Two miles east of Brasso Station; E 24; (2) northeast corner E 24; Guaico-Tamana road quarry at $7\frac{3}{4}$ mile post; also at $8\frac{1}{8}$ mile post; Brasso Venada Ravine, 3 miles east of Brasso Station; (3) eastern E 24; Machapoorie quarry; Guaico-Tamana road at 13th mile post; (4) east central E 25.

Horizons.—(1) Brasso Miocene; (2) Manzanilla Miocene; (3) Machapoorie Miocene; (4) Tamana Miocene.

Glycymeris acuticostata var. *guaica*, n. var.

Pl. 18, Fig. 1

We have a very interesting shell in the Trinidad collection which combines features of the Dominican Miocene *G.*

acuticostata Sowerby (for figure see Bull. 29, pl. 26, fig. 10) with those of the *trilobica-canal* group of Colombia and Central America. The shell is ovately rounded with 23 primary ribs. Over the younger half of the shell these are single, narrow and sharp, with concave, fairly wide interspaces, beautifully marked with very fine, concentric threads. In these respects the shell is like *acuticostata*, only that has about 30 ribs. But distally the Trinidad shell develops weak, secondary riblets as in *trilobica*, thus showing the interrelationship of the latter species with *acuticostata*. Length about 18.5, altitude 19, semidiameter 4.5 mm.

Locality.—Guaico-Tamana Road, 13th mile post.

Horizon.—Machapoorie Miocene.

***Glycymeris mendozana*, n. sp.**

Pl. 18, Figs. 6, 7

Shell fairly large, nearly perfectly circular in outline, greatly flattened, beaks extremely low. Sculpture of 40 to 44 primary ribs, simple, closely set and very sharp-edged over the earlier half of the shell, where the interspaces are narrow and sharply V-shaped. Over the later half of the shell the anterior and posterior ribs remain simple and sharp, but over the central part of the disc the ribs become very much wider and flatter distally although they still retain their ridge lines, and in each interspace a single, auxiliary, radial thread develops, very much smaller and finer than the rib, but sufficing to fill the bottom of the narrow interspace. Length 34, altitude 29, semidiameter 4 mm.

The sharp ribbing shows relationship with *G. acuticostata* Sowerby, but the Trinidad species is different in form and size, the ribs are much more numerous and the character of the interspaces is quite unlike.

Locality.—Mendoza Quarry.

Horizon.—Tamana Miocene.

Genus *ARCA* Linnæus

In the following discussion of the Arcas I am greatly indebted to Dr. Pearl G. Sheldon for many valuable suggestions.

The placing of *Noëtia* directly after *Arca*, *sensu stricto*, is here followed as in my "Arcas of the Panamic Province." This is in accordance with Dr. Sheldon's view, because of the close relationship indicated between *Arca* and *Noëtia* by the curious form *Arca (Litharca) lithodomus* Sowerby, of which only three valves have ever been found, one by Hugh Cuming and two by Mr. Olsson. (See Maury, *Palæontographica Americana*, No. 4, p. 7, 1922.)

Subgenus *ARCA*, *sensu stricto*, Lamarck***Arca occidentalis* Philippi**

Pl. 1, Figs. 1, 2

Arca occidentalis Philippi, 1847, *Abbild. und Beschr.*, vol. 3, p. 14, pl. 17b, figs. 4a-c.

Arca noæ Guppy, 1866, *Quart. Jour. Geol. Soc. London*, vol. 22, p. 293. Not of Linnæus.

Arca noæ Guppy, 1867, *Proc. Sci. Assoc. Trinidad*, pt. 3, p. 163; Harris' Reprint, 1921, *Bull. Amer. Paleont.*, No. 35, p. 42. Not *noæ* Linnæus.

Arca occidentalis Guppy, 1876, *Quart. Jour. Geol. Soc.*, vol. 32, p. 531.

Arca occidentalis Sheldon, 1916, *Palæont. Amer.*, No. 1, p. 8, pl. 1, figs. 8-11.

Arca occidentalis Maury, 1917, *Bull. Amer. Paleont.*, No. 29, p. 163, pl. 29, fig. 3; 1920, *Idem*, *Bull.* 34, p. 11.

Arca occidentalis Olsson, 1922, *Bull. Amer. Paleont.*, No. 39, p. 181, pl. 22, fig. 1.

The true Noah's Ark shell, *Arca noæ* of Linnæus, with which this species has sometimes been confused, lives in the Mediterranean Sea.

Among Trinidad Arcas, *A. occidentalis* is quickly differentiated by its striking form. An average shell measures in length 59, height 25, semidiameter 14 mm., but we have them of all sizes from 10 mm. up.

This species occurs in the Miocene of the Dominican Republic, of Jamaica, and of Costa Rica; Pliocene of Florida; Pleistocene of the Antilles. It is living in the

Antilles, on the west coast of Florida, and from Hatteras south to Yucatan.

This is the *Arca noæ* of Dr. Guppy's Matura lists. We have it from the Miocene to Recent in Trinidad.

Localities.—Springvale; Matura beds; Sans Souci Bay.

Horizons.—Springvale Miocene; Pliocene, Matura; Recent, northern coast of Trinidad.

Arca umbonata Lamarck

Pl. 3, Fig. 6; Pl. 8, Fig. 4

Arca umbonata Lamarck, 1819, Anim. sans Vert., vol. 6, p. 37.

Arca umbonata Philippi, 1847, Abbild. und Besch., vol. 3, p. 13, pl. 17b, figs. 3a-c.

Arca imbricata (Bruguière) Gabb (in part, 1873, Trans. Amer. Philos. Soc., vol. 15, p. 254. Not of Bruguière.

Arca umbonata Arango, 1879, Fauna Malacologica Cubana, p. 261.

Arca umbonata Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, pp. 620, 659; 1900, *Idem*, pl. 38, figs. 4, 4a.

Arca umbonata Sheldon, 1916, Palæontographica Amer., No. 1, p. 8, pl. 1, figs. 12-17.

Arca umbonata Maury, 1917, Bull. Amer. Paleont., No. 29, p. 164, pl. 30, fig. 11; 1920, New York Acad. Sci., Sci. Surv. Porto Rico, vol. 3, pt. 1, p. 6; 1920, Bull. Amer. Paleont., No. 34, p. 11.

Arca umbonata Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 182.

In the collection is a very small true Ark which is not the young of *A. occidentalis*. The high, full beak, very sharp and prominent carination of the umbonal slope, and sub-cancellate type of sculpture, indicate a very young specimen of *Arca umbonata*, which this with very little question is. Our shell is the only example ever found in the Trinidad Pliocene.

Arca umbonata ranges from the Tampa Oligocene to the Recent. It is living from Hatteras to Santa Caterina, Brazil, and through the Antilles. Fossil specimens are found in the Miocene of Florida, Porto Rico and Santo Domingo; and in the Pleistocene of the West Indies.

Locality.—Matura.

Horizon.—Pliocene.

Subgenus *NOËTIA* Gray

Noëtia trinitaria Guppy

Pl. 3, Figs. 1, 3, 4

- Arca trinitaria* Guppy, 1866, Quart. Jour. Geol. Soc. London, vol. 22, p. 583, pl. 26, figs. 3a, 3b.
Arca trinitaria Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 163; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 42.
Arca trinitaria Schuchert, 1905, Bull. U. S. Nat. Mus., No. 53, pt. 1, p. 57.
Arca (*Noëtia*) *trinitaria* Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, pt. 4, pp. 617, 658.
Arca (*Noëtia*) *trinitaria* Sheldon, 1916, Palæontographica Americana, vol. 1, No. 1, p. 29, pl. 7, figs. 1, 2.

Shell small, solid, subtrigonal, equivalve, very inequilateral, oblique, with high, opisthogyrate beaks; posterior area bounded by a strong, roundly angulated, umbonal carina, and so short as to be nearly flat and cordate when the two valves are together; anterior area short, with rounded margin, inner edges of shell sharply dentate; valves with about forty smooth, narrow, equal ribs, with frequently a threadlike riblet in the interspaces, as is characteristic of *Noëtia*; ribs and interspaces crossed by fine lines arching up over the ribs and down in the slightly concave interspaces; ligament with transverse grooves and lying almost wholly anterior to the beaks, not occupying the posterior part of the cardinal area where there is a smooth band; terminal teeth V-shaped. Length of a specimen with both valves in place 25, altitude 20, diameter 20 mm. A larger single valve is 26 x 23 and 13 mm. in semidiameter. A small valve 15 x 16 x 6.

This very neat species is related to the Costa Rican Miocene *Noëtia macdonaldi* Dall, and to the recent west coast *N. reversa* (Gray) Sowerby, the type of the subgenus *Noëtia*. Indeed, *trinitaria* is almost like a miniature *reversa*.

Localities.—Eastern Trinidad on the northwest side of Manzanilla Point (type locality) and various stations on Manzanilla Bay (Nos. 263, 265, 267, 272, 294, 308); West Central Trinidad in E 24; and H 3, northeastern corner; also at 11th mile post on Caparo Road.

Horizon.—Manzanilla Miocene.

Shell rather large, of very striking aspect, being an extreme form of the *Noëtia trinitaria—reversa—macdonaldi* group. General form trigonal, very high, with a narrow base, and rounded umbonal carina. Posterior area extremely compressed and flattened. In the best and largest specimen, a right valve, the ribs number about thirty, twenty situated between the carina and the anterior margin and the remaining ten on the truncated posterior area. On the center of the disc the ribs are very low, flat and rather wide, with interspaces nearly as wide as the ribs, but on the truncation the ribs are much closer and the interspaces narrow. The interstitial threads appear almost entirely obsolete. Ribs and interspaces are crossed by rather fine concentric lines of growth, arching up in the interspaces and down over the ribs, and at the basal margin the ribs project, making the edge markedly dentate. Substance of the shell rather thin for its size, but heavier near the hinge. All the specimens are very fragile and some are distorted from crushing. Beaks very high, full, acute at their apices and strongly opisthogyrate. Cardinal area wholly anterior to the beaks. Length of largest shell 40, altitude 41, semi-diameter 19 mm. Another measures 27 x 31 x 14 mm.

This species is much larger and coarser than *Noëtia trinitaria* Guppy, with which it cannot be confused. It is about the size of the living west coast shell, *Noëtia reversa* (Gray) Sowerby, and of the Miocene ancestor of that species, *N. macdonaldi* Dall. But comparison shows that it is much narrower at the base than *reversa*—the posterior margin of which is produced and pointed, while in this species the whole posterior is exceedingly flattened, and compressed, and the base rounded, not pointed. Comparison with specimens of its nearest ally, the typical form of *N. macdonaldi* from the Banana River Miocene, shows that the latter shell is thicker, more pointed posteriorly, more sharply carinate, and with ribbing closer, the interspaces almost linear, instead of nearly equaling the ribs in width

as in the Trinidad species.

Locality.—Near the Junction of Mayo and Couva main roads, west central Trinidad.

Horizon.—Brasso Miocene.

Noëtia centrota Guppy

Pl. 8, Figs. 10, 12

Arca centrota Guppy, 1867, Proc. Sci. Assoc. Trinidad, p. 175; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 54.

Arca centrota Guppy, 1873, Proc. Sci. Assoc. Trinidad, vol. 2, p. 92, pl. 3, figs. 4a, 4b; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, facing p. 75, pl. 1, figs. 4a, 4b.

Arca centrota Guppy, 1874, Geol. Mag., London, pl. 18, fig. 23.

Arca centrota Guppy, 1875, Ann. Nat. Hist., 4th ser., vol. 15, p. 51, pl. 7, fig. 4. (Recent shell figured.)

Arca (Noëtia) centrota Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, pt. 4, p. 617.

Arca (Noëtia) centrota Schuchert, 1905, Bull. U. S. Nat. Mus., No. 53, pt. 1, p. 55.

Arca (Noëtia) centrota Sheldon, 1916, Palæontographica Americana, No. 1, p. 29.

Arca (Noëtia) centrota Maury, 1922, Palæontographica Americana, No. 4, pp. 172, 173.

Shell rather small, elongated transversely, subrhomboidal, with a prominent, rounded carination passing from the beaks to the posterior margin; ribs thirty-six to thirty-eight, finely crenulated, wider than the interspaces. Interstitial thread minutely crenulated, most conspicuous over the umbonal ridge; teeth small and vertical centrally, longer and more oblique distally. Ligament area small, the anterior portion marked with transverse, parallel grooves. Length 27, altitude 15, semidiameter 8 mm.

This species is extremely abundant in the Matura beds where there are the greatest number of young and adult specimens.

Noëtia centrota is the precursor of the recent species *Noëtia martinii* Récluz (Jour. de Couch., vol. 3, p. 409, pl. 12, figs. 3–5, 1852), which is living in the Gulf of Paria and on the Brazilian coast. But Récluz's name is invalid because preoccupied by Bolten. Lamarck's unfigured *A. bisulcata* from Guiana and Brazil may be identical with

martinii and, if so, it is the valid name from the recent species.

The living west coast analogue of the *Noëtia centrotæ* (+*martinii*+*bisulcata*) group is *N. olssoni* Sheldon and Maury, from the Panamic Province (Maury, *Palæontographica Amer.*, No. 4, pp. 10, 11, pl. 1, fig. 9, 1922). The chief difference is that the west coast shell is less expanded posteriorly, and the bare strip behind the ligament is reduced, but the relation between the Trinidad fossil and the Panamic shell is very close.

In the Springvale material we found a single, very young, valve of *Arca centrotæ*. Since this species has never before been reported from beds older than Pliocene; and as the shell is very young, it may be a slightly varying ancestral form of *centrotæ*, but the specimen is indistinguishable from the young of *centrotæ*.

Localities.—Matura Bay (type locality); Springvale (young shell).

Horizons.—Pliocene, extremely abundant; Upper Miocene, very rare.

Noëtia sheldoniana Maury

Pl. 8, Fig. 11

Arca (*Noëtia*) *sheldoniana* Maury, 1912, Jour. Acad. Nat. Sci. Phila., 2nd ser., vol. 15, p. 43, pl. 8, figs. 10, 11.

Arca (*Noëtia*) *sheldoniana* Sheldon, 1916, *Palæontographica Americana*, vol. 1, No. 1, p. 69.

Noëtia sheldoniana Cossmann, 1916, *Révue Critique de Paléozoologie*, No. 3 (Juillet), p. 113.

Original description.—"Shell small, rather delicate for the genus, nearly rhomboidal, high and short; posterior slope carinate, very slightly produced; beaks nearly touching, opposite the middle of the row of teeth; moderately inflated; interstitial rib present on the posterior half of the valve. Length 15, height 13.5, thickness of valve 6 mm."

This species has thirty-eight closely-set ribs, but has somewhat the outline of a very young shell of the recent east coast *Noëtia ponderosa* Say; but the ligament is wholly anterior in *N. sheldoniana* and ends at the beak, as in *N.*

reversa, so that the characters of the cardinal area ally our Pliocene species with the west coast shell. Moreover, *N. ponderosa* has only 25–28 ribs and is a large, very thick species, in the Pliocene of North Carolina, and Recent from Cape Cod to Yucatan, but not recorded by Dr. Guppy from Trinidad. Nor is it in our Trinidad collections.

Noëtia sheldoniana is readily differentiated from *N. trinitaria* by its rhomboidal form and truncate posterior margin, *trinitaria* being trigonal and obliquely produced and pointed posteriorly.

Locality.—Along the shore 1000 feet west of Brighton pier, in black, asphaltic marl.

Horizon.—Pliocene.

***Noëtia mayensis*, n. sp.**

Pl. 5, Fig. 2

Shell rather small, transversely elongate-oval, very sharply and conspicuously carinate at the umbonal slope, and anterior to the carina sulcated and compressed. Anterior area rounded, posterior obliquely flattened and produced basally. Ribs about thirty-six, low and closely set, with narrow interspaces. Interstitial thread developed chiefly on the posterior area where there are about twelve ribs, the remaining twenty-four lying between the anterior margin and the carina. Ribs and interspaces are crossed by fine, concentric growth lines which, under a lens, divide into minute blocks the interspaces on the younger part of the valve. Beak low, medially sulcate, opisthogyrate. Cardinal area very short, posterior to the apex of the beak. Length 27, altitude 17, semidiameter 9 mm.

Although this species has a transversely elongated form, it is not like the *Noëtia centrota*—*bisculcata*—*olssoni* series, because in that group the cardinal area is long, while in this shell it is extremely short. It appears like a much lengthened out *reversa*.

Although unlike in shape, *Noëtia mayensis* and *Noëtia sheldoniana* both have interstitial ribs all the way around, and their ligamentary characters are similar. Since the

former has been somewhat crushed, it is possible that more material may prove them very closely related.

Locality.—Near Junction of Mayo and Couva main roads.

Horizon.—Brasso Miocene.

Noëtia manzanillæ, n. sp.

Pl. 8, Figs. 13, 19

Shell small, trigonal, slightly higher than long, beaks very high, acute, opisthogyrate; anterior area of shell very short, rounded; posterior area somewhat more produced; umbonal slope evenly and gently rounded, not angular. Ribs about thirty, with a microscopic interstitial thread showing clearly where the surface is well preserved. Ligament transversely grooved, high, anterior to the beak, not occupying the posterior portion of the cardinal area. Length 10, altitude 12, semidiameter 6 mm.; another specimen with both valves together measures 9 x 10 and 10 mm. in diameter.

The striking and peculiar feature of this bizarre little species is the rounded posterior slope. All members of the subgenus *Noëtia* excepting the section *Sheldonella* Maury (Bull. Amer. Paleont., No. 29, pp. 166, 167, 1917)—of which the type, *Sheldonella maoica* is so exceedingly abundant in the Cercado formation of Santo Domingo—have an angular posterior slope.

Perhaps this Trinidad species is of sectional value for it differs from *Sheldonella* in form, not being at all like the *Bathyarcas*. On the other hand, it is certainly a *Noëtia*, as its hinge clearly proves. Though small the specimens are fully grown and, indeed, rather old individuals.

Locality.—North of Manzanilla Point, northeastern coast of Trinidad.

Horizon.—Manzanilla Miocene.

Subgenus *BARBATIA* Gray

Section *CALLOARCA* Gray*Barbatia* (*Calloarca*) *candida* Gmelin

Pl. 8, Fig. 6

Arca candida Gmelin, 1792, Syst. Nat., vol. 6, p. 3311.*Arca jamaicensis* Gmelin, 1792, Syst. Nat., vol. 6, p. 3312.*Barbatia bonaczyi* Gabb, 1873, Trans. Amer. Philos. Soc., vol. 15, p. 254.*Barbatia* (*Calloarca*) *candida* Dall, 1989, Trans. Wagner Inst. Sci., vol. 3, p. 626.*Barbatia* (*Calloarca*) *candida* Dall and Simpson, 1901, Bull. U. S. Fish Comm., vol. 20, pt. 1, p. 460.*Arca* (*Barbatia*) *candida* Sheldon, 1916, Palæontographica Amer., No. 1, p. 16, pl. 3, figs. 11, 12.Not *Barbatia* cf. *Bonaczyi* Maury, April, 1917, Bull. Amer. Paleont., No. 29, p. 165, pl. 30, fig. 15.*Barbatia* (*Calloarca*) *candida* Maury, 1920, Bull. Amer. Paleont., No. 34, p. 12.(?) *Barbatia* cf. *bonaczyi* Hubbard, 1921, Sci. Surv. Porto Rico, vol. 3, pt. 2, p. 106, pl. 14, fig. 4.*Arca bonaczyi* Pilsbry, 1922, Proc. Acad. Nat. Sci. Phila., vol. 73, pt. 2, p. 403, pl. 39, figs. 1, 2. Figures of Gabb's type.

Shell, when fully grown, large, subtrapezoidal, gaping at the base anteriorly; white; anterior end generally truncate, posterior pointed; beaks high, separated by a rather wide area; surface sculptured with fine to rather strong double or single ribs which are heavier on the posterior slope, ribs intersected by irregular concentric lines and ridges producing a somewhat cancellated or beaded appearance; teeth but little developed; epidermis heavy and shaggy. Length 60, height 35, diameter 28 mm.

Barbatia candida is now living from Cape Hatteras to Santa Caterina, Brazil, and is abundant in the Antilles. It is found in the Miocene of Florida, and is common in the West Indian Pleistocene.

Gabb's Santo Domingan Miocene, *Barbartia bonaczyi*, as shown by Dr. Pilsbry's illustration of the type, is merely a young *Barbatia candida*, which is now also living on the recent beaches of that island. Thus *bonaczyi* falls into the synonymy of *candida*.

The *Arca* figured by me as *Barbatia* cf. *bonaczyi* Gabb in April, 1917, from Miocene beds of Los Quemados and the Samba Hills, Santo Domingo, was later found by Mr. Olsson

in Gatun beds at Port Limon; and as Gabb's type was then figured, he saw this *Arca* was specifically distinct and named it *Barbatia mauryæ* (Olsson, Bull. Amer. Paleont., No. 39, p. 182, pl. 22, figs. 4, 7, 1922). As Mr. Olsson compared my Dominican shells with his Costa Rica specimens there is no doubt of their specific identity, and the name he gave is valid.

Mr. Hubbard's Porto Rican *Barbatia* cf. *bonaczyi* may be like Gabb's *bonaczyi*, a young *candida*; but it is not *Barbatia mauryæ* Olsson.

Dr. Dall records *Barbatia candida* from the Pliocene of Trinidad.

We have a beautifully sculptured very young shell of *candida* measuring 10 x 6 x 2 mm.

Locality.—Matura.

Horizon.—Pliocene.

Section ACAR Gray

Barbatia (Acar) *reticulata* Gmelin

Pl. 8, Figs. 18, 21

Arca reticulata Gmelin, 1792, Systema Naturæ, 6, p. 3311.

Arca reticulata Chemnitz, Conch. Cab., 7, p. 193, pl. 54, fig. 540.

Arca squamosa Lamarck, 1819, Anim. sans Vertèbres, vol. 6, p. 45.

Arca squamosa Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 164;

Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 43.

Arca (Barbatia) reticulata Dall and Simpson, 1900, Bull. U. S. Fish Comm., vol. 20, pt. 1, p. 460.

Arca (Barbatia) reticulata Sheldon, 1916, Palæont. Amer., No. 1, p. 20, pl. 4, figs. 8-12.

Barbatia (Acar) reticulata Maury, 1917, Bull. Amer. Paleont., No. 29, p. 166, pl. 30, fig. 16; 1920, Scientific Surv. Porto Rico and the Virgin Isls., vol. 3, pt. 1, p. 7; 1920, Bull. Amer. Paleont., No. 34, p. 13; 1922, Palæont. Amer., No. 4, p. 19.

Barbatia (Acar) reticulata Hubbard, 1921, Sci. Surv. Porto Rico, vol. 3, pt. 2, p. 106.

This beautiful little shell is closely related to the West Coast *Barbatia gradata* Broderip and Sowerby. It is easily recognized among Trinidad Arcas by its rich sculpturing. Our largest specimen of *reticulata* from Trinidad measures in length 22, altitude 7, and semidiameter 5 mm.

It is an ancient, static species, first appearing in the

Jacksonian Eocene. At Ponce, Porto Rico, it is in Miocene beds and also living on the Ponce reefs. It ranges in the modern seas from Florida to Texas, and Hatteras to Panama; and is in the Mediterranean Sea.

Lamarck questioned whether his *Arca squamosa* was not identical with Gmelin's *reticulata*. Dr. Dall thinks it is, and that *domingensis* Lamarck and *clathrata* Lamarck are also synonyms of *reticulata*.

Dr. Guppy, in 1867, listed this species (as *squamosa*) from the Matura beds.

Locality.—Matura, northeastern Trinidad.

Horizon.—Pliocene.

Barbatia (Acar) milifilia var. **latrinidadis**, n. var. Pl. 8, Fig. 3

We have half a dozen specimens of a Trinidad member of the rare and beautiful group of Arcas represented by only two species—on the east coast by the Pliocene *A. milifilia* Dall, from Shell Creek, Florida, and on the west coast, Panamic Province, by the living species, *A. illota* Sowerby, of which C. B. Adams' *A. tabogensis* from Taboga Island, Bay of Panama, is a synonym. These two species, *milifilia* and *illota* are very much alike, the living form differing chiefly in the more handsomely developed radial sculpture with tertiary threads. Their striking resemblance, as I noted in 1922, suggests an Atlantic origin and a trans-Isthmian Pliocene migration of the stock—representatives never having been found in beds earlier than that period.

A comparison of *milifilia* (Dall, Trans. Wagner Inst. Sci., vol. 3, pt. 6, pl. 56, figs. 21, 24 and Expl. of plate, p. 1629, 1898) and of *illota* Sowerby (Maury, Palæontographica Amer., No. 4, p. 20, pl. 2, figs. 8, 14, 1922) shows their close affinity.

It is extremely interesting to find a similar *Arca* in the Pliocene of Trinidad. These shells are greatly like *milifilia* but appear a little longer proportionately, less sulcate mesially, and with finer, sharper, less granose ribbing.

Larger shells measure in length 19, altitude 13, semidiameter 5 mm.

The hinge of this group is typically that of *Acar*, but a single shell of our *illotas* showed a blending of the hinge characters of *Acar* and of *Calloarca*; indicating a transition between these two sections of *Barbatia*.

For the Trinidad shells the varietal name *latrinidadis* is suggested, from the nearby triad mountain that inspired Columbus to name the Island in honor of the Holy Trinity.

Locality.—Matura.

Horizon.—Pliocene.

Section *FOSSULARCA* Cossmann

Barbatia (Fossularca) adamsi (Shuttleworth) Smith Pl. 8, Figs. 1, 8

Arca cœlata Conrad, 1845, Fos. Medial Tert., p. 61, pl. 32, fig. 2.

Not *Arca cœlata* Reeve, 1844, Conch. Icon., *Arca* No. 110.

Arca lactea of C. B. Adams. Not the true *lactea* Linnæus, which is European.

Arca solida Guppy, 1864, Trans. Sci. Assoc. Trinidad, p. 36; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 16.

Not *Barbatia solida* Sowerby, 1833, Proc. Zool. Soc. London, p. 18, which is the West coast analogue.

Arca adamsi Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 164; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 43.

Arca (Acar) adamsi Shuttleworth (MS.), Smith, 1888, Jour. Linn. Soc., Zool., vol. 20, p. 449, pl. 30, figs. 6, 6a.

Barbatia (Fossularca) adamsi Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, pt. 4, p. 629.

Arca adamsi Sheldon, 1916, Palæontographica Americana, No. 1, p. 22, pl. 4, figs. 16, 17, 18, pl. 5, fig. 1.

Arca (Fossularca) adamsi Vaughan and Woodring, 1921, Geological Reconnaissance Dominican Republic, pp. 150, 168.

Barbatia (Fossularca) adamsi Maury, 1922, Palæont. Amer., No. 4, p. 22.

From the west central part of the Island we have a small, worn *Arca* which is, however, undoubtedly a specimen of *Fossularca adamsi* (Shuttleworth) Smith; and we have also a number of well preserved specimens from the Matura beds.

This very small, but well marked little species is trapezoidal in form with the basal margin slightly sinuate, and

the umbonal slope carinate, especially just behind the beaks. The sculpture is of many radial riblets formed by rows of trailing blisters, very easily worn off. Towards the basal margin secondary riblets are intercalated. The ligament occupies a small diamond-shaped area between the beaks, and the series of hinge teeth is interrupted opposite to the ligament. A Matura specimen measures in length 11, altitude 7, semidiameter 3.5 mm.

This species has a wide geologic range—from the Miocene of Florida; North Carolina; Bowden, Jamaica; Gurabo formation, Dominican Republic; Pliocene of Florida, to the Recent. It is now living from Cape Hatteras to the Island of Fernando Noronha, Brazil.

The Pacific analogue is *Fossularca solida* Sowerby, living from San Diego, California, to Paita, Peru. Dr. Guppy reported *adamsi* (as *solida*) from the Matura beds.

Localities.—West central Trinidad in the southwest quarter of E 24; also northeastern Trinidad at Matura.

Horizon.—The age of S. W. E. 24 is doubtfully Manzanilla Miocene; Matura is Pliocene.

Section *CUCULLARIA* Conrad

Barbatia (*Cucullaria*) *perinopinata*, n. sp.

Pl. 6, Fig. 12

Arca tæniata Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 454, pp. 5, 9; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, pp. 161, 165.

Not *Barbatia* (*Cucullaria*) *tæniata* Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 631, pl. 25, figs. 1, 1a.

Shell rather small, oblong, moderately inflated, with a strong, wide, radial sulcation passing from the umbo to the basal margin which it renders deeply arcuate. Beaks low, umbonal slope rounded; hinge line straight but the other hinge characters are concealed. The single specimen is a badly preserved cast, but on the umbonal slope of the right valve is a small area where the sculpture is shown. It consists of very closely set, finely crenate, very narrow, paired, radial ribs. Interspaces linear hardly exceeding the

line between each member of a pair of ribs. Length 39, altitude 23, diameter 18 mm.

This species appears nearest to *C. tæniata* Dall, from the Pliocene of Florida, but the Trinidad shell is smaller and of different form, the sulcus more central, and the ribs over the umbonal slope show a paired rather than a quadripartite plan, the interspaces being narrower than in Dr. Dall's shell.

I have described this shell in spite of its poor preservation because of the rarity of this section of Barbatias. The species of *Cucullaria* now living along the Atlantic coast are in general deep-sea loving. *C. paserula* Sheldon, 1916 (*asperula* Dall, 1881, name preoccupied by Deshayes, 1860), ranges from Fernandino to Yucatan in 310–1568 fathoms; *C. profundicula* Verrill was dredged from 2021 fms., Lat. 37° N.; *C. sagrinata* Dall, from 80 fms., off Cuba; *C. lactocomata* Dall, from 82 to 169 fms., off Martinique and Barbados; *C. pteroëssa* E. A. Smith, is both Atlantic and Pacific, having been dredged by the *Challenger* off the Azores; off Culebra Island, West Indies; and in the North Pacific.

Locality.—Springvale.

Horizon.—Upper Miocene.

Subgenus SCAPHARCA Gray

Section SCAPHARCA Gray

Scapharca (*Scapharca*) *secticostata* Reeve

Pl. 1, Fig. 4

Arca secticostata Reeve, 1844, *Conch. Iconica*, *Arca*, pl. 6, fig. 38.

Anadara secticostata Gray, 1857, *Ann. Nat. Hist.*, 2d ser., vol. 19, p. 371.

Anomalocardia floridana Conrad, 1869, *Amer. Jour. Conch.*, vol. 5, p. 108, pl. 13, fig. 2.

Scapharca secticostata Dall, 1898, *Trans. Wagner Inst. Sci.*, vol. 3, pp. 636, 637, 659; 1903, *Idem*, p. 1616.

Arca (*Scapharca*) *secticostata* Sheldon, 1916, *Palæontographica Americana*, No. 1, p. 36, pl. 8, figs. 3, 4, 5.

Scapharca (*Scapharca*) *secticostata* Maury, 1920, *Bull. Amer. Paleont.*, No. 34, p. 16.

This is the cut-ribbed Ark of which we have two recent Trinidad specimens. It is a rather rare species, oblong, very convex, with thirty-three to forty ribs, a large number being deeply medially grooved. Length of larger specimen 90, altitude 56, semidiameter 29 mm.; smaller, 55 x 35 x 14 mm.

Frequently this shell has been confused with its Miocene ancestor, *Scapharca lienosa* Say. It ranges through the Gulf of Mexico and from Cape Hatteras to Trinidad. It does not antedate the Pleistocene, being found in beds of that age in Florida.

Locality.—West coast of Trinidad, between Ally and Mosquito Creek.

Horizon.—Recent.

Scapharca (*Scapharca*) *halidonata* Dall

Pl. 5, Fig. 8

Arca consobrina Guppy, 1866, Quart. Jour. Geol. Soc., London, vol. 22, p. 293.

Not *Arca consobrina* Sowerby, 1849, Quart. Jour. Geol. Soc., vol. 5, p. 52, pl. 10, fig. 12, which is *Scapharca henckeni* Maury, April, 1917 (*sobrina* Pilsbry and Johnson, May, 1917).

Arca consobrina Guppy, 1874, Geol. Mag., London, p. 443.

Scapharca (*Scapharca*) *halidonata* Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 646, pl. 33, fig. 24.

Arca consobrina Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, p. 14; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 156.

Scapharca (*Scapharca*) *halidonata* Sheldon, 1916, Palæont. Amer., No. 1, p. 49, pl. 11, fig. 8.

Scapharca (*Scapharca*) *halidonata* Maury, 1917, Bull. Amer. Paleont., No. 29, p. 168.

Shell rather large, oblong-ovate, inflated; beaks moderately high, strongly prosograte, placed at about the anterior fourth of the total length. Ribs thirty-four, the anterior dozen medially grooved, posterior ribs with three or more grooves; ribs on the posterior slope with a single groove, or entire. Length of shell 55, altitude 40, diameter 40 mm. Large shells attain a length of 68 mm.

This shell is of the general type of the living *Arca* (*Scapharca*) *secticostata*, but much shorter proportionately.

Dr. Guppy's *Arca consobrina* Sowerby, from Jamaica was this species. Sowerby's type was Dominican.

This species is not so high as *Scapharca couvæ* Maury, from the Springvale Miocene, and the anterior ribs are bipartite—never quadripartite or tripartite, as in that shell.

Localities.—Bowden, Jamaica (Olsson coll.) ; Curaçao (Dall).

Scapharca (Scapharca) auriculata Lamarck

Pl. 4, Fig. 2

Arca auriculata Lamarck, 1819, Anim. sans Vertèbres, vol. 6, p. 43.

Arca auriculata Reeve, 1844, Conch. Icon. *Arca*, pl. 6, fig. 35.

Arca (Scapharca) auriculata Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, pt. 4, p. 649; 1903, *Idem*, pt. 6, p. 1586.

Arca (Scapharca) auriculata Sheldon, 1916, Palæont. Amer., No. 1, p. 50, pl. 11, fig. 19.

Scapharca (Scapharca) auriculata Maury, 1917, Bull. Amer. Paleont., No. 29, p. 175, pl. 28, fig. 3; 1920, *Idem*, No. 34, p. 18.

Arca auriculata Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 130, pl. 22, fig. 3.

Shell of medium size, inflated, ovate-oblong; posterior dorsal margin emarginate, forming a slight but definite alation, hence the specific name. Ribs about twenty-five, rounded, entire, very finely crenate. Inner margin of valves dentate. Epidermis seal brown. Length 45, altitude 31, semidiameter 15 mm.

This well-known shell has been recorded from Key West to Martinique. It occurs also in the Miocene of Santo Domingo, Jamaica, and Costa Rica. We have gathered recent specimens on the Texas coast and on the beach at Monte Cristi, Dominican Republic. We now extend its southward range to Trinidad.

Locality.—Erin Point, on the southwestern shore of the Island.

Horizon.—Recent.

Scapharca (Scapharca) dehayesi Hanley

Pl. 4, Fig. 3

Arca dehayesi Hanley, 1842, Illust. Catalogue Bivalve Shells, p. 157.

Arca dehayesi Reeve, 1844, Conchologica Iconica, *Arca*, pl. 7, fig. 47.

Arca (Anadara) dehayesi Gabb, 1874–1881, Jour. Acad. Nat. Sci.

Phila., 2d ser., vol. 8, p. 378.

Arca deshayesi Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 659.

Arca deshayesi Dautzenberg, 1900, Mém. Soc. Zool. France, vol. 13, p. 236.

Arca deshayesi Dall and Simpson, 1901, Bull. U. S. Fish, vol. 20, pt. 1, p. 461.

Arca deshayesi Dall, 1901, Proc. Washington Acad. Sci., vol. 3, p. 141.

Arca deshayesi Sheldon, 1916, Palæontographica Americana, No. 1, p. 50, pl. 11, figs. 15, 16, 17, 18.

Shell rather large, resembling *A. auriculata* Lamarck in general form; nearly equivalve; ribs about twenty-six, of which the anterior and those around the umbonal ridge are medially grooved towards the base of the valve. Epidermis dark brown, scaly. Sectional characters intermediate between those of *Scapharca* and of *Anadara*. Length 60, altitude 42, diameter 43 mm.

A rare species. We have examples from Guadeloupe and Jamaica. It ranges as far south as Pernambuco, Brazil. Gabb reported it from the Pliocene of Costa Rica.

The young shells of *A. deshayesi* are auriculate at the upper posterior margin and are practically inseparable from *A. auriculata*. Adult specimens differ from that species in attaining a larger size, losing their alation, and in the medial grooving of the anterior and umbonal slope ribs.

We have a single fossil valve from Curaçao which is probably *A. deshayesi*, but differs in being barely alate even in young stages (as shown by growth lines); and the hinge is of moderate width, while in our few specimens of *deshayesi* it is delicate for the size of the shell. This valve measures 50 x 40 x 21 semidiameter. It also resembles *A. halidonata* Dall, but is closer to *A. deshayesi*, which is a better horizon, *deshayesi* being recent and, *fide* Gabb, Pliocene, while *halidonata* is Miocene. As this specimen is somewhat intermediate between these two species, it may indicate a line of descent from *halidonata* to *deshayesi*.

Dautzenberg, in 1900, placed the *Arca hemidermos* Philippi of d'Orbigny (In de la Sagra's Hist. Fisica, Pol.

y Nat. de la Isle de Cuba, vol. 5, *Moluscos*, p. 345, 1845) in the synonymy of *deshayesi*. D'Orbigny did not figure his specimens which were from Cuba and Martinique; and we have not Philippi's illustration (Abbild. Conch. *Arca*, pl. 2, fig. 5, 1845) of the type of *A. hemidermos*.

Locality.—Island of Curaçao, three miles inland, east of the dock. (Harris coll.).

Horizon.—Quaternary.

Scapharca (*Scapharca*) couvæ, n. sp.

Pl. 7, Fig. 1

Shell rather large, ovate; anterior area short, rounded basally, angulate at the hinge line; posterior area defined by a very prominent, angular umbonal carina, beyond which the posterior slope is concavely excavated; posterior end somewhat produced, subrostrate, junction with hinge angulate. Beaks high and very full, prosogyrate. Ribs thirty to thirty-three. Of these, about twenty-four are anterior to the umbonal carina and each rib of the anterior and central part of the valve bears three or four radial threads finely knotted or beaded, so that the ribs appear tripartite or quadripartite. Ribs high and square-topped. Cardinal area small for the size of the shell, lozenge-shaped, with about three concentric grooves. Hinge showing numerous teeth, the anterior somewhat larger and oblique. Margins of valves fluted. Length 50, altitude 45, diameter 32 mm.

A fine and striking species, quickly distinguished from other Trinidad *Arcas* by its form and sculpture.

In sculpture it recalls the smaller *Scapharca dodona* Dall, from the Miocene of Oak Grove, Florida. But in that shell the interspaces are much narrower, only half as wide as the ribs, while in our shell they are subequal to the ribs.

Our shell also bears some resemblance to *halidonata* Dall, from the Miocene of Bowden, Jamaica; but that species is longer in proportion to its height and is considerably thicker, and also differs in details of sculpture.

Scapharca veatchi Olsson, from the Canal Zone Miocene has the *Argina* shape, with rounded umbonal slope, and the interspaces are comparatively narrower; while this Trinidad shell has the angular *Scapharca* shape, with the carinate umbonal slope.

Locality.—Springvale, near Couva, Trinidad.

Horizon.—Upper Miocene.

Scapharca (Scapharca) tectum-columbæ, n. sp.

Pl. 7, Fig. 4

Shell of medium size, subrhombic, with the umbones only moderately inflated, and general aspect of shell flatish; anterior end convexly rounded, posterior subcompressed, bluntly pointed, umbonal slope rounded, posterior dorsal area flattened; hinge line very straight, sharply angled at both extremities; ribs thirty-nine, of which twenty-nine are in front of the umbonal slope, and ten on the posterior area; about ten of the anterior ribs are grooved, nearly all being bipartite, but two or three are tripartite and on an older shell they become quadripartite distally. There is also the usual tendency for a few of the ribs on the umbonal slope to be medially grooved, although only several on the left valve show this feature. The anterior ribs are crenulated by coarse, concentric threads which traverse the interspaces and rise over the ribs. The cardinal area is long and narrow, wider in front, with the anterior portion much shorter than the posterior. Beaks approximate, narrow, subacute. Length of shell with both valves together 40, altitude 32, diameter 21 mm.

This pretty shell is somewhat *Pteria*-like in form. It is distinguished from *Scapharca couvæ* (1) by the cardinal area which is long and narrow, while in *couvæ* it is short for the size of the shell and much less unsymmetrical; (2) by the close, narrow, pointed beaks, while in *couvæ* the beaks are separated, broader, not curving so closely over the area; (3) by the much more numerous and less subdivided ribs, the ribs in *couvæ* being also higher and squarer;

(4) by the flatter, much less inflated form of the shell, *couvæ* being higher, more inflated, and very convex in the umbonal region.

In general form, *Arca tectum-columbæ* may be likened to *A. callicestosa* Dall, from the Miocene of Virginia.

Locality.—Springvale, Trinidad.

Horizon.—Upper Miocene.

Scapharca (*Scapharca*) *confugium*, n. sp.

Pl. 7, Fig. 3

Shell rather large, oblong-ovate, rounded anteriorly, produced and pointed posteriorly, with the umbonal slope carinated, especially proximally. Beaks low, incurved, not much inflated. Valves with markedly discrepant sculpture. A left valve with the sculpture preserved over the central and posterior areas shows the central ribs to be medially sulcated with a tendency to further division, while the ribs on the umbonal slope are chiefly quadripartite or sometimes tripartite. Length of shell 56, altitude 32 mm.

This species is much longer in proportion to its height than *Scapharca couvæ*, the beak is much lower and less inflated, the ribs much lower, and there is more discrepancy in the two valves. The different form at once distinguishes it from *tectum-columbæ*.

Locality.—Springvale.

Horizon.—Upper Miocene.

Scapharca (*Scapharca*) *henekeni* Maury

Pl. 6, Fig. 10

Arca consobrina Sowerby, 1849, Quart. Jour. Geol. Soc. London, vol. 5, p. 52, pl. 10, fig. 12.

Not *Arca consobrina* d'Orbigny, 1844, Pal. Française, Terr. Crét., vol. 3, p. 209, pl. 311, figs. 4-7 (which is the true *consobrina*).

Not *Arca consobrina* Guppy, 1866, Quart. Jour. Geol. Soc. London, vol. 22, p. 293 (which is *halidonata* Dall).

Arca (*Anadara*) *consobrina* Gabb, 1873, Trans. Amer. Phil. Soc., vol. 15, p. 253.

Arca consobrina Guppy, 1876, Quart. Jour. Geol. Soc., vol. 32, p. 531.

Arca consobrina Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, pt. 4, p. 646.

?*Arca consobrina* Guppy, 1910, Agric. Soc. Trin. and Tobago, Paper No. 440, p. 14; Harris' Reprint, 1921, Bull. Amer. Paleont.,

No. 35, p. 156.

Arca consobrina Sheldon, 1916, Palæontographica Americana, No. 1, p. 49.

Arca (Scapharca) henekeni Maury, April, 1917, Bull. Amer. Paleont., No. 29, pp. 167, 168, pl. 29, fig. 2.

Arca (Scapharca) sobrina Pilsbry and Johnson, May, 1917, Proc. Acad. Nat. Sci. Phila., vol. 69 (for 1917), 1918.

Arca (Scapharca) henekeni Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 186, pl. 24, figs. 13, 14.

Arca (Scapharca) sobrina Pilsbry, 1922, Proc. Acad. Nat. Sci. Phila., vol. 73, p. 403.

We have three valves from the Machapoorie quarry which appear to be young specimens of *Scapharca henekeni* Maury. The shells are oblong, with about thirty-five ribs, which are grooved and beaded, except posteriorly where they are nearly smooth. Careful comparison of these shells with young or smaller specimens probably *henekeni* from Cercado de Mao, Bluff 3, shows a close resemblance, although the more typical specimens are larger and from Bluff 2, Cercado de Mao, Dominican Republic.

Locality.—Machapoorie Quarry, west central Trinidad.

Horizon.—Machapoorie Miocene.

Scapharca henekeni var. *trinidadensis*, n. var.

Pl. 7, Fig. 5

Shell of medium size, oblong, somewhat expanded posteriorly, anterior area very short; beaks exceedingly far forward; umbonal slope with a rounded carination from the beak to the posterior margin. Ribs twenty-nine, those of the anterior and central portions of the valve being conspicuously medially grooved, posterior ribs entire. Hinge characters concealed by matrix. Length of shell 40, altitude 20, semidiameter 10 mm.

This shell has some of the characters of *Scapharca henekeni* and, as the specimen is unique and the surface somewhat worn, it seems best to regard it at present as a varietal form. More material later may show it to be specifically distinct. The distinguishing feature is the very anterior position of the beaks.

Locality.—Central Trinidad, southwest from Brasso, in

the southwest corner of E 25.

Horizon.—Probably Lower, or Lower Middle Miocene.

Scapharca (Scapharca) dariensis Brown and Pilsbry Pl. 6, Fig. 5

Arca oronlensis Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 658.
Not of Gabb.

Arca dariensis Brown and Pilsbry, 1911, Proc. Acad. Nat. Sci. Phila.,
vol. 63, p. 362, pl. 22, fig. 10.

Arca gatunensis Toulal, Dec., 1911, Jahrb. der K-K. Geol. Reichsan-
stalt. Wien, vol. 61, p. 493, pl. 30, fig. 4.

Arca dariensis Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 184,
pl. 22, figs. 10-13.

Shell small, transversely elongate. Ribs thirty, those on the anterior area and umbonal slope medially divided; on the right valve the anterior and umbonal are finely and prettily crenulate, while the central ribs are smooth and narrow; on the left valve all the ribs are usually crenate. Length 28, altitude 17, semidiameter 8 mm.

Locality.—Gatun.

Horizon.—Middle Miocene, Gatun formation.

Scapharca (Scapharca) fontinalis, n. sp.

Pl. 6, Figs. 7, 8

Shell resembling *S. henekeni* Maury, in general form, but differing in the following respects: The substance of the shell is thinner; the beak is less anterior and more central; the anterior end of the shell is more produced, and is not so cut away basally; the hinge line and basal line are much more nearly parallel; the ribs are more numerous (40 against 35 or 36) and are less divided, only the first seven or eight being medially grooved, and there being no tendency at all for the ribs over the central or umbonal regions to divide (which not infrequently happens in *henekeni*).

This absence of any tendency of the ribs to divide over the umbonal slope indicates that this shell is distinct, and not a variety merely of *henekeni*. Length 51, altitude 27 mm.

Locality.—Springvale.

Horizon.—Upper Miocene.**Scapharca (Scapharca) brassica**, n. sp.

Pl. 8, Fig. 7

Shell rather small, thin and delicate, oval; sculptured with about thirty-one ribs, all of which are medially grooved excepting the last three at the dorsal posterior margin. The grooving thus extends right over the rounded umbonal slope. The sulcations are deep and rather wide so that only two narrow, nodosely beaded ridges are left on either side of each rib. The beading is especially marked on the anterior fourth of the shell, but all the ribs are more or less crenate except the last three which are smooth and entire. Hinge concealed. Length of shell 26, altitude 18 mm.

This pretty shell has some resemblance to *Scapharca inæquilateralis* Guppy, but differs in its produced posterior end. It is also related to, but specifically distinct from *S. henekeni* Maury. The distinguishing feature is the extended grooving embracing all but the last few ribs.

Locality.—Half a mile above Brasso Station in a blue, shaly clay.

Horizon.—Lower Springvale Miocene, just above the uppermost member of the Brasso Miocene.

Scapharca (Scapharca) inæquilateralis Guppy

Pl. 6, Fig. 6

Arca inæquilateralis Guppy, 1866, Quart. Jour. Geol. Soc. London, vol. 22, p. 293, pl. 18, fig. 2.

Arca inæquilateralis Guppy, 1867, Proc. Sci. Assoc. Trinidad, p. 163; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 42.

Scapharca (Scapharca) inæquilateralis Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, pt. 4, p. 647.

Arca inæquilateralis Sheldon, 1916, Palæontographica Amer., No. 1, p. 50.

Scapharca inæquilateralis Maury, 1917, Bull. Amer. Paleont., No. 29, p. 171, pl. 30, fig. 2.

Arca inæquilateralis Pilsbry, 1922, Proc. Acad. Nat. Sci. Phila., p. 403.

From central Trinidad we have a worn shell which has the shape and aspect of this pretty, delicate, Bowden and Dominican Ark, and is almost certainly identical with it.

Scapharca inæquilateralis Guppy is related to *latiden-*

tata Dall, from the Florida Miocene. The type of *inæquilateralis* had about thirty crenate ribs, grooved on the anterior and posterior areas. The hinge is long and straight, with many fine teeth. The shell is not much inflated, is thin, and daintily sculptured. A large specimen measures in length 29, altitude 15, semidiameter 7 mm.

This species is found in the Bowden beds, Jamaica; and the Gurabo formation, Dominican Republic. This is the first time it has ever been reported from Trinidad.

Locality.—Two miles east of Brasso Station.

Horizon.—Brasso Miocene.

Scapharca (Scapharca) patricia Sowerby

Pl. 2, Fig. 5

Arca patricia Sowerby, Quart. Jour. Geol. Soc. London, vol. 5, p. 52, 1849.

Arca patricia Moore, Quart. Jour. Geol. Soc., vol. 9, p. 129, 1853.

Arca (Anadara) grandis Gabb, Trans. Phil. Soc., vol. 15, p. 253, 1873.

Arca patricia Guppy, Geol. Mag. London, p. 443, 1874; Quart. Jour. Geol. Soc., vol. 32, p. 531, 1876.

Arca grandis Gabb (in part), Jour. Acad. Nat. Sci. Phila., vol. 8, 2d ser., p. 378, 1874–1881.

Arca patricia Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, pt. 4, pp. 642, 658.

Arca patricia Guppy, 1903, Bull. Trinidad Botanical Dept., p. 541 (Tobagan Fossils); Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, pp. 131–133.

Arca patricia Sheldon, 1916, Palæont. Amer., No. 1, p. 49.

Scapharca (Scapharca) patricia Maury, 1917, Bull. Amer. Paleont., No. 29, pp. 173, 174; pl. 27, fig. 1.

Arca (Scapharca) patricia Vaughan and Woodring, 1921, Geol. Reconnaissance Dominican Republic, pp. 154, 164.

Arca patricia Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 19.

Scapharca patricia Maury, 1922, Palæont. Amer., No. 4, pp. 32, 33.

A large worn *Arca* from central Trinidad corresponds in form, size, and ribbing with our specimens of *Arca patricia* Sowerby from Santo Domingo, the type locality, and seems specifically identical. It measures in length 103, altitude 93, semidiameter 40 mm., and as it was not an old individual it might have attained an even larger size.

Dr. Guppy reported *patricia* from the Caroni series, Trinidad, and from the Robinson Crusoe Island of Tobago, northeast of Trinidad.

It is sometimes said that *Arca patricia* Sowerby is "lost," or is identifiable with *chiriquiensis* Gabb. But Sowerby was a conchologist of fine discrimination, and his comparison of *patricia* with *Arca grandis*, as well as the very name of his Dominican species indicate that he had this splendid, noble Ark, which is abundant there, and not the smaller, comparatively insignificant *chiriquiensis* of Gabb. Some specimens of the patrician Ark can be found which cannot be distinguished from *A. grandis* Broderip and Sowerby; but *patricia* instantly brings to mind the East coast fossil, and *grandis* its living west coast representative and descendant. There are a number of similar cases of this usage in other genera.

The characters of *Arca patricia* are on the borderland between *Anadara* and *Scapharca*, *sensu stricto*, and as the former seems an artificial group, it is placed here in the latter section.

In Santo Domingo our *Arca patricia* beds at Caimito were above a concealed part of the section and their position could not be exactly determined, but they certainly were high up in the Miocene section. Dr. Vaughan later corroborated this and found *A. patricia* in the Cerros de Sal formation, of Upper Miocene age.

Professor Harris, from field observations, found the Trinidad *A. patricia* horizon stratigraphically far above the Springvale Miocene.

Localities.—Gomez Estate, about $1\frac{3}{4}$ miles southwest of Todd's Railroad Station, Caroni Department; Ward's Shack near 3-mile post Freeport-Todd's Road; Freeport-Todd's Road (No. 550).

Horizon.—Uppermost Miocene, above the Springvale Miocene.

Scapharca patricia var. *waringi*, n. var

Pl. 3, Figs. 2, 5

Shell moderately large with about twenty-seven ribs which are more or less crenulated by coarse, transverse lines. In general form resembling young shells of *Scaph-*

arca patricia, but none of the many specimens attain the size of an adult shell of that species. Although small, however, they are in many cases very old shells as the gerontic characters of the ligamentary area prove. They constitute a dwarf variety of the true *patricia*, that would seem to mark the approaching extinction of the race. A large specimen measures in length 72, altitude 62, semidiameter 32 mm., others are 70 x 61 x 32, 57 x 54 x 26, 53 x 50 x 28.

The shape of this variety is not altogether like that of the true *patricia*. It differs from *chiriquiensis* chiefly in its larger size.

Locality.— $\frac{1}{4}$ mile north of Point Paloma, Manzanilla Coast; also an unnamed headland, north of Manzanilla Point towards the mouth of the Oropuche River, north-eastern Trinidad.

Horizon.—Upper Miocene. A lignitic eastern phase about equivalent stratigraphically to the western Springvale.

Scapharca (Scapharca) chiriquiensis Gabb

Pl. 2, Fig. 2

Scapharca chiriquiensis Gabb, 1861, Proc. Acad. Nat. Sci. Phila., vol. 12, p. 567.

Scapharca (Scapharca) chiriquiensis Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, pt. 4, pp. 642, 643.

Arca chiriquiensis Sheldon, 1916, Palæontographica Americana, vol. 1, p. 49.

Scapharca (Scapharca) chiriquiensis Maury, 1917, Bull. Amer. Paleont., No. 29, p. 174, pl. 28, fig. 2.

Arca chiriquiensis Pilsbry (in part), 1922, Proc. Acad. Nat. Sci. Phila., vol. 73, p. 405, pl. 40, figs. 2, 3, 4-6. (Gabb's types.)

Exclude *patricia* Sowerby.

Arca (Scapharca) chiriquiensis Woodring, 1924, Geology Republic of Haiti, pp. 188, 194, pl. 16, figs. 6, 7, 8.

In the collection from the northeastern coast are several valves which may be the young of *Scapharca chiriquiensis* Gabb. They resemble young specimens of that species from the Dominican Republic. All are badly preserved, crushed and exfoliated, and positive identification is not possible. Yet it is certain that they are either the young of *chiriquiensis* or of a closely related form.

This species is found in Chiriqui, Central America; on an island in Lake Henriquillo, southern Santo Domingo; Sabaneta to Guayubin Road, northern Santo Domingo; Thomonde formation and Maissade Tongue, Haiti. The latter beds are placed by Dr. Woodring in the Lower Miocene. On the Sabaneta to Guayubin Road in Santo Domingo, however, we found *A. chiriquiensis* with *A. patricia*, and that horizon from other faunal affinities also seemed very much higher. This Dominican horizon would accord better with the Trinidad horizon than would the Haitian.

Locality.—Six hundred feet north of Pointe Noir, northeastern coast of Trinidad.

Horizon.—Pointe Noir Miocene. An eastern lignitic phase, about equivalent stratigraphically to the western Springvale beds which are Upper Miocene.

Scapharca chiriquiensis var. *stamineopsis*, n. var.

Pl. 2, Fig. 1

Shell of medium size, ovate-oblong, with about twenty-seven ribs which are more or less nodular, especially anteriorly. Beaks situated at about the anterior third of the total length of the shell. Length 34, altitude 30, semi-diameter 15 mm.

This Ark is related closely to *Scapharca chiriquiensis* Gabb, but is much smaller than that species. Though less produced posteriorly, in some respects it recalls *Scapharca websteri* Pilsbry, from Haiti; and like it seems best placed as a variety of *chiriquiensis*.

In form it approaches the Maryland Miocene species, *Scapharca staminea* Say, but the character of the ribbing is unlike.

Locality.—North of Manzanilla Point, northeast coast of Trinidad.

Horizon.—Middle Miocene.

Scapharca chiriquiensis var. *carolinoides*, n. var.

Pl. 2, Fig. 4

Associated with the preceding variety, and to some

extent grading into it, are specimens also belonging to the *Arca chiriquiensis* group. But extreme examples of these shells approach bilateral symmetry and the beaks are more nearly central. This is the distinguishing character of this form. Ribs about twenty-seven, nodose anteriorly. Length of shell 26, altitude 23, semidiameter 10 mm.

This bears the relation to *stamineopsis* that *Arca carolinensis* Wagner, characterized by central beaks, bears to *Arca idonea* Conrad, characterized by anterior beaks.

Locality.—North of Manzanilla Point.

Horizon.—Middle Miocene.

Scapharca (Scapharca) pointnoirensis, n. sp.

Pl. 8, Fig. 2

Shell small, rounded and evenly inflated, the umbonal slope not defined; the beaks so nearly central that the left valve appears almost bilaterally symmetrical. The right valve is less rounded with a more produced, narrower appearance, indicating that the two valves were unequal, the right fitting inside the left, and because of this the bilateral symmetry is less marked in the right valve. The valves are sculptured with about twenty-three entire ribs, wider than the interspaces; ribs on the right valve nearly smooth on the umbonal region, crenulate anteriorly; on the left valve, ribs crenulate. Hinge characters, so far as exposed, those of the section *Scapharca*. Length of shell 18, altitude 15, semidiameter 5 mm.

Locality.—Six hundred feet north of Pointe Noir, north of Manzanilla Point, northeastern coast of Trinidad.

Horizon.—Pointe Noir Miocene, about equivalent stratigraphically to the Springvale beds, which are Upper Miocene.

Scapharca (Scapharca) promentoriana

Pl. 2, Fig. 3

Shell small, ovate-oblong, delicate, evenly inflated, anterior and posterior margins rounded; beaks situated at about the anterior third of the total length of the shell. Surface

sculptured with twenty-two entire, rounded ribs about equal to their interspaces. Ribs anteriorly nodose, posteriorly smooth. Hinge not exposed, but the general appearance of the shell is that of a member of the section *Scapharca*. Length of shell 29, altitude 19, semidiameter 8 mm.

This shell is at once recognized by its large, widely spaced ribbing, giving a very pretty, fluted appearance to the valves. For this type of shell it has very few ribs and is rather unique.

Locality.—Six hundred feet north of Pointe Noir, northeast coast of Trinidad.

Horizon.—Pointe Noir Miocene, about equivalent to the Upper Miocene of Springvale, west central Trinidad.

***Scapharca (Scapharca) cunearcopsis*, n. sp.**

Pl. 8, Fig. 16

Shell small, subtrigonal, oblique, inflated; anterior area very short, posterior area produced; umbonal slope roundly carinated. Ribs about twenty-five, nodosely crenate anteriorly, smoother posteriorly. Length of shell 22, altitude 18, semidiameter 8 mm.

This species has the form of a *Cunearca*, but the beaks are closely incurved over a rather narrow cardinal area, indicating that it should be placed in the section *Scapharca*, although grooves on the cardinal area were not seen because of the adherence of the matrix.

Locality.—Six hundred feet north of Pointe Noir, northeastern coast of Trinidad.

Horizon.—Pointe Noir Miocene, a lignitic phase about equivalent to the west central Springvale beds, which are Upper Miocene.

***Scapharca (Scapharca) thauma*, n. sp.**

Pl. 1, Fig. 3

Shell large, handsome, oblong-elongate, rather heavy and solid; valves with about thirty-nine ribs, wider than the interspaces, ribs over the anterior area medially grooved, the first eight or ten conspicuously so; the ribs and interspaces are crossed by concentric threads which on

the grooved ribs, where the surface is perfectly preserved, make a pretty, herring-bone pattern of parallel series of bars sloping in opposite directions from the central furrow. Hinge line long, teeth centrally short, fine, vertical; distally oblique, curving and broken up. Cardinal area long and wide with about five grooves (seven on a very old valve), not very regular. Length of shell 100, altitude 52, semidiameter 27 mm. The very large specimen is imperfect but its altitude is 60 and semidiameter 30 mm.

In form this splendid Ark recalls *Scapharca margarætæ* Maury, from the Dominican Miocene of Rio Cana, but that has only thirty-one ribs which are entire, and narrower than the interspaces, and the style of ribbing is like that of *aresta* and *campsa* of the Florida Miocene, which is not the case in this Trinidad species. In general aspect this shell also resembles *lienosa* Say, from the Virginia Miocene, but the ribs, except anteriorly, are not divided as in that species.

Scapharca formosa Sowerby, of the west coast, is a modern representative of this handsome group.

Locality.—Springvale, near Couva, Trinidad.

Horizon.—Upper Miocene.

Scapharca (*Scapharca*) *oropuchensis*, n. sp.

Pl. 4, Fig. 6

Shell large, very heavy, solid, trigonal, nearly equilateral, in form approaching an isosceles triangle. Ribs about twenty-eight, over the umbonal region they are sharply medially grooved, elsewhere the surface is worn, but probably the ribs were more or less grooved excepting those on the posterior slope. Ligamentary area wide, with worn traces of V-shaped grooves; hinge wide and heavy, teeth long. Length of shell 85–90, approximate altitude 75–80, semidiameter 30 mm.

This is a *Scapharca* remotely related to the *Arca idonea* Conrad group of the Maryland Miocene; and to the *Arca patricia-grandis* group; the *idonea* and *grandis* groups being somewhat akin—with shells high and full, with a short,

high ligamentary area, and long hinge teeth. The quickly distinguishing feature of the species now described is its markedly isosceles form and solid, heavy structure, with ribs more or less grooved.

Locality.—Northeast coast of Trinidad, half a mile south of the mouth of the Oropuche River.

Horizon.—Upper Miocene—same as the Pointe Noir beds, and stratigraphically equivalent to the Springvale Miocene of west central Trinidad.

Scapharca (*Scapharca*) *transversa* var. *sancti-davidis*, n. var.
Pl. 6, Fig. 3

Shell of moderate size, oblong, rather slightly and evenly inflated; anterior and posterior ends rounded. Ribs about thirty-three, rounded, entire, nodose anteriorly, largest over the umbonal slope. Beaks low, medially sulcated; hinge narrow, teeth fine centrally, larger distally. Length 31, altitude 22, semidiameter 9 mm.

This species resembles the Recent to Upper Pliocene shell, *Arca transversa* Say, but in *transversa* the basal and hinge lines are almost parallel; while in this Trinidad ancestral shell the basal and hinge lines are placed at a widely divergent angle.

This variety forms a link in the Recent to Miocene phylogenetic chain of *Arca transversa*, *plicatura*, *improcera*, and *arata*.

Locality.—Matura.

Horizon.—Pliocene.

Scapharca (*Scapharca*) *esperanza*, n. sp. Pl. 6, Fig. 1

Shell transversely elongate-oblong, flattish, with a slight, but evident, median radial sulcation. Beaks low, situated at about the anterior third of the total length of the shell. Ribs about twenty-seven, all entire, the anterior somewhat crenate from raised growth lines, otherwise the ribs are smooth. They show no tendency to grooving. The ribs are flat and noticeably wider as they reach the umbonal

slope. Interspaces not nearly as broad as the ribs. Cardinal area very narrow. Teeth concealed. Length of shell 29, altitude 17, semidiameter 7 mm.

At first glance this might be taken, because of its general outline, for a member of the *Scapharca transversa* group; but the very narrow cardinal area shows that it does not belong in the *transversa* series.

Its affinity seems to be with the living west coast *Scapharca emarginata* Sowerby, illustrated in my Panamic Arcas (Palæontographica Americana, No. 4, p. 23, pl. 2, figs. 5, 10, 1922), which it resembles in flatness of form, central radial sulcation, and widening of the ribs over the umbonal slope. That species, however, has the dorsal posterior margin notched, and in both our Trinidad fossils that portion of the shell is missing, so one cannot tell whether it was emarginate or not.

Locality.—Brasso Junction quarry.

Horizon.—Brasso Miocene.

Scapharca (*Scapharca*) *balboæ* Sheldon

Arca dalli Brown and Pilsbry, 1912, Proc. Acad. Nat. Sci. Phila., p. 510, pl. 24, fig. 4.

Not *Arca* (*Macrodon*) *dalli* Smith, 1885, Challenger Report, vol. 13, p. 269, pl. 17, figs. 10, 10b.

Arca balboæ Sheldon, 1916, Palæont. Amer., No. 1, p. 69.

Arca invalida Hanna, 1924, Proc. Cal. Acad. Sci., 4th ser., vol. 13, No. 10, p. 157.

Dr. G. Dallas Hanna, in his recent "Rectifications of Nomenclature," gave the name *invalida* to Brown and Pilsbry's *Arca dalli*. He overlooked the fact that Dr. Pearl Sheldon had already renamed this Isthmian shell.

From its form, this species is probably a *Scapharca*, but the interior of the type was concealed.

We have no specimens of *A. balboæ* in our collections.

Locality.—Culebra Cut, Isthmus of Panama, in a lignitic clay.

Section *CUNEARCA* Dall*Scapharca (Cunearca) incongrua* Say

Pl. 7, Fig. 6

Arca incongrua Say, 1822, Jour. Acad. Nat. Sci. Phila., vol. 2, p. 268.*Arca incongrua* Reeve, 1844, Conch. Icon., *Arca*, pl. 8, fig. 50.*Scapharca (Cunearca) incongrua* Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 635.*Arca (Cunearca) incongrua* Sheldon, 1916, Palæont. Amer., No. 1, p. 59, pl. 14, figs. 4-7.*Scapharca (Cunearca) incongrua* Maury, 1920, Bull. Amer. Paleont., No. 34, p. 18.

Shell subrhomboidal, inequivalve, the left valve the larger, sculpture discrepant on the two valves; ribs twenty-six to thirty; ligament covering all the cardinal area and bordered by a sharp groove; hinge teeth longer and oblique distally; epidermis, when still remaining on the shell, thin, light brown. Length 54, altitude 43, semidiameter 19 mm.; other specimens measure 53 x 43 x 17 mm.; 50 x 40 x 16 mm.

This species in its typical form is distributed from North Carolina to Texas, south of which it merges into *brasiliانا*. Typical *incongrua* does not antedate the Pleistocene.

Scapharca (Cunearca) brasiliانا Lamarek

Pl. 4, Figs. 1, 4, 5

Arca brasiliانا Lamarek, 1819, Anim. sans Vertèbres, vol. 6, p. 44.*Arca brasiliانا* Philippi, 1843, Abbild. und Besch., vol. 1, *Arca*, p. 2, pl. 1, fig. 3.Not *Arca brasiliانا* Reeve, 1844, Conch. Icon., *Arca*, pl. 3, fig. 17, which is *bifrons* Carpenter, a west coast specimen.*Arca incongrua* Guppy, 1864, Trans. Sci. Assoc. Trinidad, p. 41; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 21.*Arca incongrua* Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 163; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 42. Not *incongrua* Say.*Scapharca (Cunearca) brasiliانا* Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 635.*Arca brasiliانا* Sheldon, 1916, Palæont. Amer., No. 1, p. 59, pl. 14, fig. 8.*Scapharca (Cunearca) brasiliانا* Maury, 1922, Palæontographica Amer., No. 4, p. 36.

This is the southern form of the northern *Arca incongrua* Say. It differs from that species in being smaller, and proportionately shorter and higher. Its distribution is from

Texas southward to São Paulo, Brazil. Lamarck's type of *brasiliانا* was from Rio de Janeiro and measured 35 mm. Our Trinidad shells are as follows: Length 34, altitude 30, semidiameter 14 mm.; 35 x 30 x 14; 40 x 34 x 16; 39 x 37 x 16 mm.

Cunearca brasiliانا resembles the west coast *C. bifrons* Carpenter, but is distinct specifically, as d'Orbigny stated years ago.

The relationship between *brasiliانا* and *incongrua* is rather puzzling. They merge at their boundary line, yet extreme forms are unlike; and I follow Dr. Dall's suggestion that at least tentatively they should be kept separate.

Localities.—Coast of Trinidad from Ally to Mosquito Creek; on the beach of Matura Bay; and at Mayaro Point.

Horizon.—Recent of Trinidad. Also Pliocene of Costa Rica (Dall). Dr. Guppy remarked on the absence of this species (as *incongrua*) from the Matura Pliocene.

Scapharca (Cunearca) sancti-andreae, n. sp.

Pl. 5, Fig. 6

Shell small, subrhombic, anterior end rounded, posterior end pointed; umbonal slope sharply carinate, and in front of this carina is a radial sulcation. Ribs thirty, on the left valve all handsomely and conspicuously beaded. Between the beads are striations which about the center of the valve are oblique instead of transverse, giving these ribs the effect, under a lens, of a miniature cable of rope. Hinge teeth smaller and closer, but not obsolete centrally; longer, slightly oblique, distally. Interior of valve very strongly and sharply furrowed by the external ribbing. Beak small, acute, not as high as in a *brasiliانا* of equal size. Length of largest shell 25, altitude 21, semidiameter 9 mm.; smaller specimens measure 14 x 12 x 5; 10 x 8.5 x 4 mm.

This very pretty shell is allied to *Arca incongrua*, *brasiliانا* and *scalaris*, but does not seem identical with any of these species. It is much more strongly beaded than *incongrua* and its southern form, *brasiliانا*—the cross striæ are

further apart than in those shells; the beak is lower, the inner margin more fluted, and the posterior end more pointed. In general appearance this Trinidad shell is most like small specimens of *Arca scalaris* Conrad, which it greatly resembles in form and in details of sculpture. But it has more ribs than that species, which is found in the Miocene of Virginia, Carolina and the upper bed at Alum Bluff, Florida.

Locality.—Matura.

Horizon.—Pliocene.

Scapharca (Cunearca) filicata Guppy

Pl. 8, Fig. 5

Arca filicata Guppy, 1866, Quart. Jour. Geol. Soc. London, vol. 22, p. 583, pl. 26, fig. 5.

Arca filicata Guppy, 1867, Proc. Sci. Assoc. Trinidad, p. 163; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 42.

Arca filicata Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, pt. 4, p. 636.

Arca filicata Schuchert, 1905, Bull. U. S. Nat. Mus., No. 53, p. 56.

Arca (Cunearca) filicata Sheldon, 1916, Palæont. Amer., No. 1, p. 61, pl. 15, fig. 5.

Shell small, subquadrate, oblique, somewhat inequivalve; ribs about thirty, nodosely crenate, nearly smooth on the center of the right valve; beaks high, very full, apices rather distant, being separated by a wide lanceolate ligamental area; hinge straight, angulate anteriorly and posteriorly; central teeth vertical; terminal more or less oblique. Length 19, altitude 17, diameter 16 mm.

Localities.—West side of Manzanilla Point (type locality); central E 24; southwest quarter of E 24, which is in the west central part of the island; 11th mile post on Caparo Road.

Horizon.—Manzanilla Miocene.

Scapharca (Cunearca) chemnitzii Philippi

Arca rhombea var. *Chemnitz*, 1784, Conch. Cab., vol. 7, p. 212, pl. 56, f. 553, lit. b.

Not *Arca rhombea* Born, 1778, Mus. Cæs. Vind., p. 76; Reeve, Conch. Icon., pl. 2, fig. 12 (the true *rhombea*).

Arca chemnitzii Philippi, 1851, Zeitschr. für Malakozoologie, vol. 8,

p. 50.

Noëtia orbigny (Kobelt) Dall, 1889, Bull. 37, U. S. Nat. Mus., p. 40.
Scapharca (Cunearca) chemnitzii Dall, 1898, Trans. Wagner Inst. Sci.,
 vol. 3, pp. 636, 659.

Scapharca (Cunearca) chemnitzii Maury, 1912, Jour. Acad. Nat. Sci.
 Phila., vol. 15, pp. 44, 45.

Scapharca (Cunearca) chemnitzii Sheldon, 1916, Palæont. Amer., No.
 1, p. 60, pl. 15, figs. 3, 4.

Scapharca (Cunearca) chemnitzii Maury, 1920, Bull. Amer. Paleont.,
 No. 34, p. 19; 1922, Palæont. Americana, No. 4, p. 34.

This species was confused with *Arca rhombea* Born, from the Indian Ocean. Dr. Dall thinks *Cunearca chemnitzii* is identical with the *A. antillarum* of Dunker, and with the *A. bicops* Philippi of d'Orbigny (Moll. de l'Amér. Mérid., p. 652, No. 715; Hist. Pol. y Nat. Isla de Cuba, pt. 2, vol. 5, *Moluscos*, p. 343). In the Gulf of Mexico it ranges from West Florida to Texas, and in the Atlantic through the West Indies to Colon and southward.

Fossil members of the *Cunearca chemnitzii* group of the West Indies and Florida are: *C. filicata* Guppy, *C. chemnitziioides*, *C. alcima* Dall, and the Costa Rican Miocene forms, *C. pittieri* Dall, *C. lloydi* Olsson, and *C. hindsi* Olsson.

The living analogue on the west coast is *Cunearca nux* Sowerby.

Locality.—Gulf of Paria at Brighton Beach.

Horizon.—Recent.

Scapharca (Cunearca) chemnitziioides Maury

Arca (Cunearca) chemnitziioides Maury, 1912, Jour. Acad. Nat. Sci.
 Phila., vol. 15, p. 44, pl. 7, figs. 13, 14, 15, pl. 8, fig. 1.

Arca (Cunearca) chemnitziioides Sheldon, 1916, Palæont. Amer., No. 4,
 p. 34.

Original description.—"Shell trigonal, short and high with prominent and widely separated beaks; cardinal area diamond-shaped with transverse striations and without V-shaped grooves; this and the general form show it belongs to the section *Cunearca*. Nearly all the specimens are in the form of internal molds, but several were casts of the exterior and guttapercha impressions of these show

the ribs were beaded as indicated in the figure.

"Length of an average sized mold 22, height 21, diameter 16.5 mm."

In certain characters, this species recalls the *Arca* (*Cunearca*) *cumanensis* Dall (Trans. Wagner Inst. Sci., vol. 3, pp. 633-634, 1898) from the Cumana, Venezuela beds.

This species is differentiated from *incongrua* by the high, narrow beaks and wide cardinal area.

As the specific name implies, this Trinidad fossil is closely related to the modern *Cunearca chemnitzii* Philippi. A larger allied form is *C. alcima* Dall from the Florida Pliocene.

Locality.—Brighton, Trinidad, south of Pitch Lake, on the southern road, in ferruginous marl.

Horizon.—Upper Miocene.

Scapharca (*Cunearca*) *cumanensis* Dall

Pl. 5, Fig. 4

Arca incongrua Guppy, 1867, Proc. Sci. Assoc. Trinidad, p. 163; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 42. Not *A. incongrua* Say.

Scapharca (*Cunearca*) *cumanensis* Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, pt. 4, p. 633.

Scapharca (*Cunearca*) *cumanensis* Sheldon, 1916, Paleont. Amer., No. 1, p. 61.

Scapharca (*Cunearca*) *cumanensis* Maury, 1917, Bull. Amer. Paleont., No. 29, p. 180.

Arca (*Cunearca*) cf. *cumanensis* Maury, 1920, Sci. Surv. Porto Rico and the Virgin Islands, vol. 3, pt. 1, pp. 11, 12.

This species is now figured for the first time, Dr. Dall having kindly loaned a left valve of *A. cumanensis* from an island in Lake Henriquillo, southern Santo Domingo, and one of the type localities. Dr. Dall writes that this valve is almost an exact match of Guppy's Cumana valve on which the species was founded. It measures in length 28 mm., altitude 25, semidiameter 12.

Of our Trinidad Arcas, *A. cumanensis* is nearest to *A. sancti-andreae* from the Pliocene of Matura but the two species are entirely distinct. In *cumanensis* the diameter is greater, the beak being very much fuller; the marked sul-

cation parallel to the umbonal ridge is lacking; the interspaces are wider; and, judging from left valves, the discrepancy in size of the two valves is much less in *cumanensis*. This is indicated by the fact that in *sancti-andreae* the mark of the right valve is much further within the crenulated margin of the left than in *cumanensis*. The cardinal area is wider in *cumanensis*, and the general shape of the shell recalls that of *chemnitzii*, while that of *sancti-andreae* recalls *incongrua* and *scalaris*.

Localities.—Island in Lake Henriquillo, southern Dominican Republic; Cumana, Venezuela. (Perhaps also at Aguada, Porto Rico.)

Horizon.—Probably Middle Miocene. Equivalent to the Gatun and Gurabo formations.

Scapharca (Cunearca) sancti-blasii, n. sp. Pl. 6, Fig. 4; Pl. 8, Fig. 9

A moderately small *Cunearca* with the usual form of this section, but less erect than *A. chemnitzii*. Its inflation is moderate. The anterior end is curved outward, giving the shell a more equilateral, and less oblique, appearance than is usual in the group. The ribs number about thirty-two and are nearly smooth except for a few at the anterior end.

Besides the internal molds of two left valves we have the upper part of the corresponding cast of the exterior of one of these, and a modeling clay impression of this is figured. We have no right valve, but this might be still smoother and have narrower ribs, although the sculpture could not be very discrepant—since the left is the valve which usually shows the strong sculpture. Hinge narrow, with fine teeth. Cardinal area without incipient grooves. Length 23, altitude 21, semidiameter 10.5 mm.

Locality.—St. Blaise Ravine, near the south coast of Trinidad, in the division of Moruga.

Horizon.—A new locality found by Professor Harris of the same age as that of La Luna Point, west of Moruga Point. They are about equivalent to the Manzanilla series,

and are the Moruga beds of Guppy. Fossils very rare.

Scapharca (Cunearca) tabaquita, n. sp.

Pl. 8, Fig. 14

Shell rather small, thin and delicate in substance, sub-rhomboidal—unusual in shape for *Cunearca*—rather flat, only gently inflated; umbonal slope roundly carinate, but near the beak more sharply so; beak sulcated, as though dimpled, at the apex. Ribs on the left valve about twenty-eight, those over the central part of the disc being wide, flat and smooth, which is uncommon on the left valve of *Cunearca*; posterior ribs narrower than the central, smooth and flat, ribs of the anterior third prettily beaded with transverse ripples. Hinge characters as in *Cunearca* except that some, but not all, of the specimens show groovings—this feature being variable in this species, as it also is in *Cunearca chemnitzii*, and indicating the borderland between *Cunearca* and *Scapharca*, *sensu stricto*. Length of shell 22, altitude 16, semidiameter 7 mm. All of our specimens are left valves.

This species is striking because of its form, and the wide, flat ribbing, smooth on the center, rippled anteriorly.

Localities.—8½ miles on the Tabaquite Road, near the Tabaquite oil field in the southeastern corner of the Department of Caroni, that is, about the center of the island. Also a specimen from Brasso Junction quarry.

Horizon.—Lower Miocene about equivalent to the Tamana horizon (type locality); also Brasso Miocene (Middle Miocene).

Cunearca tabaquita var. *molesta*, n. var.

Pl. 7, Fig. 2

Associated with the preceding species are several shells of more trigonal and more inflated form, with higher beaks, more carinated umbonal slope, and narrower ribs. The general aspect is far less striking than that of *C. tabaquita* and more the ordinary form of *Cunearca*. The beak is sulcated at the apex, moderately full, but not nearly so inflated as in *C. filicata*. Cardinal area marked off by incised lines.

Central teeth fine, distal longer, oblique, curving. Ribs on left valve about twenty-eight, more or less crenate, especially anteriorly. Length of shell 20, altitude 15, semidiameter 7 mm.

A puzzling shell, perhaps best placed as a varietal form.

Localities.— $8\frac{1}{2}$ miles on the Tabaquite Road, central Trinidad. Also Brasso Junction quarry.

Horizons.—Lower Miocene, about the Tamana horizon, and Brasso Miocene (Middle Miocene).

Scapharca (Cunearca) pittieri var. *narivana*, n. var.

Pl. 8, Figs. 15, 17, 20

The type of *Arca pittieri* Dall was collected by Professor Pittier near Limon, Costa Rica. It was described by Dr. Dall (Smithsonian Misc. Coll., vol. 59, No. 2, p. 9, 1912) but never figured until Mr. Olsson illustrated his examples from the Gatun beds of the Banana River, Costa Rica (Bull. Amer. Paleont., No. 39, p. 192, pl. 24, figs. 2-6, 1922).

Mr. Olsson's figures 2 and 4, with the very high umbo and quite strongly beaded ribs, may be taken as typical, since these correspond to the original description. We have an incomplete specimen from Brasso Junction quarry which, as far as one can judge from its imperfect condition, may have been like the typical form.

The rest of our Trinidad specimens agree with Mr. Olsson's figure 5, but not with his other figures of *A. pittieri*, nor with Dr. Dall's description which says that the sculpture of the two valves is alike.

As in the type, this variety has about twenty-six ribs; but our shells differ from Dr. Dall's description in having nearly smooth ribs over the umbonal ridge of the right valve, and on the left valve the umbonal ribs are much less beaded than in Mr. Olsson's figures 2 and 6. The posterior side of the umbo is squarish rather than rounded. The striking features of this variety are the comparative smoothness of the ribbing and the lower beak. The largest shell measures in length 30, altitude 23, semidiameter 12

mm. Some specimens have the base slightly sinuate.

This *Cunearca* bears some resemblance to *C. tabaquita*, but is distinct specifically because the left valve is quite unlike the left valve of that species in form and in character of ribbing and beading.

Localities.— $\frac{1}{2}$ mile above Brasso Station; Brasso Junction quarry, west central Trinidad.

Horizon.—Brasso Miocene.

Section *ARGINA* Gray

Scapharca (Argina) campechensis Dillwyn

Pl. 7, Fig. 8

Arca campechensis Gmelin, 1792, Syst. Nat., vol. 6, p. 3312 (description inadequate).

Arca campechensis Dillwyn, 1817, Descr. Cat. Rec. Shells, vol. 1, p. 238. Not of Wood, 1825, Ind. Test., p. 46, pl. 9, fig. 28.

Arca campechensis Ravenel, 1834, Cat. Coll., p. 5.

Arca campechensis Arrango, 1880, Moll. Cubana, p. 262.

Scapharca (Argina) campechensis Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 650.

Arca (Argina) parizensis Maury, 1912, Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 15, p. 47, figs. 7, 8, 9.

Arca (Argina) campechensis Sheldon, 1916, Palæontographica Americana, No. 1, p. 61, pl. 15, figs. 6-13.

Arca (Argina) campechensis Maury, 1920, Bull. Amer. Paleont., No. 34, p. 19.

Argina campechensis is the only *Argina* of the recent East Coast and Antillean faunas.

The earliest description of this shell was by Lister, more than a century and a half ago, who described it as a *Pectunculus*, densely and deeply striated, of an oval shape, and inhabiting the Bay of Campeachy. The typical form is therefore the southern, which is small and rounded.

Near its northern limit, Cape Cod, Mass., the shell is large, coarse, earthy and densely hirsute—this is variety *pexata* Say. The more elongated, porcellaneous form of the shell, on the South Carolina shore, is variety *americana* Gray.

Our recent Trinidad specimens are the typical southern form. The ribs number about thirty-one to thirty-

three. Length 32, altitude 26, semidiameter 11 mm.

We have *Argina campechensis* from the Pleistocene of the Gulf States, and it is recorded from that of Georgia, South Carolina, New Jersey and southern New England; but this species has never been identified with certainty in horizons earlier than the Pleistocene.

In 1912, I tentatively named a recent *Argina* from the beach between La Brea and San Fernando, *A. pariænsis*, because it differed somewhat from *A. campechensis*. But after studying our much larger new collections from Trinidad I think *pariænsis* was merely a mutation of *campechensis*.

Localities.—Along the shore Ally to Mosquito Creek, southwestern Trinidad; West of Brighton; Megaro Bay; Hillside near Bontour Point, 75 feet above the sea (perhaps carried by birds).

Horizon.—Recent.

Scapharca (*Argina*) *tolepiæ* Dall

Arca pexata Guppy, 1867 (in part), Proc. Sci. Assoc. Trinidad, pt. 3, p. 164; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 43; 1874, Geol. Mag. (in part). (Haitian and Cumana specimens.)

Not *Arca pexata* Say, 1822, Jour. Acad. Nat. Sci. Phila., vol. 2, p. 268.

Scapharca (Argina) tolepiæ Dall, 1898, Trans. Wagner Insd. Sci., vol. 3, pt. 4, p. 649, pl. 33, figs. 7, 8.

Scapharca (Argina) tolepiæ Sheldon, 1916, Palæont. Americana, No. 1, p. 63, pl. 15, figs. 14, 15.

Scapharca (Argina) tolepiæ Maury, 1917, Bull. Amer. Paleont., No. 29, p. 342.

A small, thin, greatly inflated, rounded species, with finer and more nodulose sculpture than *A. campechensis*, but approaching in outline the typical, rounded, southern form of that species. Length of type 28, altitude 26, diameter 27 mm.

It is so inflated as to be nearly globose, which at once differentiates this shell from its descendant, *A. campechensis*.

The type locality was the Miocene of Rio Anima, Dominican Republic. Also from Bowden, Jamaica, and Dr. Dall included Dr. Guppy's Cumana specimens. Not re-

corded from Trinidad.

Scapharca (Argina) brightonensis Maury

Pl. 7, Fig. 7

Arca (Argina) brightonensis Maury, 1912, Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 15, p. 46, pl. 8, figs. 4, 5, 6.

Arca (Argina) brightonensis Sheldon, 1916, Palæontographica Americana, No. 1, p. 69.

Original description.—"Shell rather small for the genus, oval-elongate, cardinal area very narrow, hinge teeth in the two unequal series characteristic of this section *Argina*, the anterior set being very short; ribs on the left valve about thirty, lightly grooved over the central portion of the valve. Length 24, height 17, diameter 16 mm."

This shell approaches in form *Argina campechensis*, but on comparing it with several hundred specimens of that species, I find that shells of the same size of *campechensis* are invariably rounded and flatter than this Trinidad shell—which, moreover, antedates the Pleistocene—Recent *A. campechensis*.

Locality.—Brighton, along the shore 700 feet east of the pier, in impure asphalt.

Horizon.—Upper Pliocene.

Scapharca (Arginia) billingsiana Maury

Pl. 6, Fig. 2

Arca (Argina) billingsiana Maury, 1912, Jour. Acad. Nat. Sci., Phila., vol. 15, p. 45, pl. 8, figs. 2, 3.

Arca (Argina) billingsiana Sheldon, 1916, Palæontographica Americana, No. 1, p. 69.

In Trinidad a race of *Arginas* developed differing from the *Argina campechensis* group, and characterized by their transverse form, the basal line running nearly parallel with the hinge.

Though very unlike the typical, southern, *campechensis*, this group of *Arginas* does somewhat resemble small specimens of the variety *americana* Gray, from the Pleistocene and Recent faunas of the Carolinas. But that is a much longer shell, its distribution is much more northern, and it

does not antedate the Pleistocene.

A marked example of these Trinidad *Arginas* is the Upper Tertiary species, *Argina billingsiana*, which may be taken as typical of this race.

Original description.—“Shell transversely oval-elongate, rather thick and strong, beaks nearly touching, incurved over the narrow cardinal area which is similar to that of *Arca campechensis* Dillwyn; ribs of the left valve generally simple, sometimes faintly grooved, about twenty-nine in number. Length of shell 31, height 22, thickness of one valve 10 mm.”

In its form this species recalls numbers of the *Scapharca* (*Scapharca*) *transversa* Say group, but its hinge characters are those of the section *Argina*—that is, the teeth of the anterior series are shorter, irregular and broken up, while those of the posterior series are longer, normal.

A reexamination of the type of *A. billingsiana* only strengthens my belief of 1912 that it is specifically distinct from *A. campechensis* Dillwyn.

Locality.—Along the shore, 700 feet east of the Brighton pier, Trinidad, in a black, asphaltic marl.

Horizon.—Upper Pliocene.

Argina billingsiana var. *schultzana* Maury

Pl. 5, Fig. 1

Arca (*Argina*) *schultzana* Maury, 1912, Jour. Acad. Nat. Sci., Phila., 2d ser., vol. 15, p. 46, pl. 7, figs. 10, 11, 12.

Arca (*Argina*) *schultzana* Sheldon, 1916, Palæontographica Americana, No. 1, p. 69.

Original description.—“This recent species has much the aspect of *Arca* (*Argina*) *billingsiana* of which it is undoubtedly the descendant. As with the fossil shell, the outline resembles that of the larger members of the group *Arca* (*Scapharca*) *transversa* Say, but the species is at once differentiated from those shells by the characters of the hinge teeth. The latter are those of typical *Argina*; a short, broken anterior set and a long, normal posterior row. The ribs number about thirty; cardinal area very narrow, beaks

approximate, depressed, placed within the anterior fifth of the greatest length of the shell. Length 35, height 25, diameter 22 mm.

Locality.—Brighton, south of the pier, in a sandy cove of the Gulf of Paria.

Horizon.—Recent.

Argina billingsiana var. *maturensis*, n. var.

Pl. 5, Fig. 3; Pl. 6, Figs. 9, 11

Shell transversely elongate-oval, rather thin, anterior end rounded, posterior rounded, end slightly flaring, basal margin often somewhat arcuate; beaks very low, touching; ribs thirty-three to thirty-six, a few on either valve being sometimes lightly grooved. Hinge delicate, teeth in the two series characteristic of *Argina*. Largest shell incomplete but its approximate length was 40, height 27, semidiameter 11 mm. Others measure 33 x 23 x 10, 30 x 21 x 9, 30 x 20 x 9, 23 x 15 x 6.

This Pliocene shell from northeastern Trinidad appears nearest to *Argina billingsiana* from the Brighton Pliocene, southwestern Trinidad. It differs from that species in being thinner in substance, less inflated, with much lower umbo, greater number of ribs, and in the rounded, somewhat flaring, posterior outline—instead of being contracted and pointed as in the Brighton shell.

Locality.—Matura.

Horizon.—Pliocene.

Genus *OSTREA* Linnæus

Ostrea haitensis Sowerby

Pl. 9, Figs. 1, 2

Ostrea haitensis Sowerby, 1849, Quart. Jour. Geol. Soc. London, vol. 5, p. 53.

Ostrea haitensis Gabb, 1873, Trans. Amer. Phil. Soc., vol. 15, p. 257.

Ostrea haitensis Guppy, 1876, Quart. Jour. Geol. Soc. London, vol. 32, p. 532.

Ostrea haitensis Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, pt. 4, p. 685.

Ostrea haitensis Joukowski and Clerc, 1906, Mém. Soc. Phys. et d'Hist.

Nat. de Genève, vol. 35, p. 170, pl. 6, figs. 20-23, 32-35.

Ostrea haitensis Maury, 1917, Bull. Amer. Paleont., No. 29, p. 182, pl. 31, figs. 1, 2.

Ostrea haitensis Cooke, 1919, Carnegie Inst., Publ. No. 291, p. 129, pl. 7, figs. 1, 2, pl. 8, fig. 1.

Ostrea haitensis Woodring, 1924, Geol. Republic of Haiti, p. 204.

This large and handsome species is typically oblong, but sometimes nearly circular, and aged shells become exceedingly massive and heavy. Both valves are plicated, but the flatter valve less strongly so. The plications frequently divaricate. Sowerby's type from Santo Domingo had only six or seven plications, but we have a Dominican specimen with fourteen, and Cuban shells may have twelve or more. A typical Trinidad specimen of moderate size, with about seven plications, and oblong form measures 115 mm. in altitude, 90 in breadth and 25 in semidiameter. A larger valve is 140 x 120 x 25. Some valves show fine striations near the beak.

Synonyms of *O. haitensis*, *fide* Dr. Dall, are *O. veatchi* Gabb, 1869, *heermanni* Conrad, 1853, and *vespertina* Conrad, 1869.

The affinities of *Ostrea haitensis* are with *Ostrea gatunensis* Brown and Pilsbry, from the Gatun beds of Panama, and with *O. antiguensis* Brown, from the Island of Antigua and of which Dr. Reeds collected beautiful specimens at Guanica Harbor, Porto Rico. *O. antiguensis* has a wide furrow on the convex valve dividing the seven plications into two sets of five and of two. In *O. gatunensis* the plications rarely divaricate. *Ostrea haitensis* is found in the Miocene of Santo Domingo, of Haiti, Cuba, Jamaica, Florida, and we can now add Trinidad.

Locality.—Springvale.

Horizon.—Upper Miocene.

Ostrea puelchana d'Orbigny

Pl. 10, Figs. 1, 2; Pl. 11, Figs. 1, 2; Pl. 12, Figs. 9, 10

Ostrea puelchana d'Orbigny, 1842, Paléontologie de l'Amérique Méridionale, p. 162, No. 177.

Ostrea puelchana d'Orbigny, 1843, Voyage dans l'Amérique Méridio-

nale, vol. 5, pt. 3, *Mollusques*, p. 672, Atlas, pl. 85, figs. 25, 26.
Ostrea puelchana Maury, 1912, Jour. Acad. Nat. Sci. Phila., 2d ser.,
vol. 15, p. 40, pl. 5, figs. 3-5, 9, 10.

This is a very abundant fossil species in Trinidad. Examination of a quantity of these oysters of all sizes and from various localities show that they are all the same species for we have now intermediate sizes between the large and small forms that we had in 1912. This corroborates Dr. Dall's opinion, in 1912, that the large and the small forms were the same species.

The convex valve usually shows its area of attachment at the umbonal region; and in the vicinity of the umbo it typically becomes very thick, convex, and as it were hump-backed. The latter seems a characteristic feature. The surface of the convex valve is marked with very many, very irregular, coarse growth lines and lamellar ridges showing periods of interrupted or slow growth. The flatter valve is often somewhat flexed, is smooth or with growth lines, the beak is frequently pointed and salient, often curved. Aged shells have very heavy beaks. Specimens with both valves together measures as follows: 50 x 33 x 32, 90 x 60 x 45, 115 x 75 x 60 mm. A crude, irregular, hunchbacked shell, variable, yet showing these general features by which it is readily recognized.

Localities.—Union Estate, Brighton at Ridgewood, ½ mile from Bamboo Station; Union Estate at Usine Fork, between Usine River and Vessing River; and Usine Fork, 1000 feet north of Forest Reserve Road; Vessigny oil fields, Brighton; near Point Trinidad; halfway between Machapoorie and Brasso Stations No. 30; 2 miles south of Matura Bay, No. 244. Also very large specimens from eastern Venezuela in a raised terrace.

Horizons.—Middle Miocene; Upper Miocene (Union Estate and Vessing oil field); Pliocene; Pleistocene; Recent.

Ostrea virginica Gmelin

Ostrea virginica Gmelin, 1792, Syst. Nat., p. 3336.

- Ostrea virginica* Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 164; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 43.
Ostrea virginica Gabb, 1873, Trans. Amer. Phil. Soc., vol. 15, p. 257.
Ostrea virginica Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 687.
Ostrea virginica Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, p. 7; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 150.
Ostrea virginica Maury, 1917, Bull. Amer. Paleont., No. 29, p. 184; 1920, *Idem*, No. 34, p. 24.

From Matura we have quantities of young forms, many quite minute, and a few adult specimens which resemble shells of *Ostrea virginica* Gmelin.

Dr. Guppy cited this species from Matura and from the Caroni series. We have a young shell, probably this species, also from beds of that age; but, as I noted in 1917, there is some doubt whether true *virginica* is older than Pliocene.

Localities.—Matura; Springvale.

Horizons.—Pliocene and Upper Miocene.

Ostrea messor, n. sp.

Pl. 10, Figs. 3, 4

- Ostrea megodon* Dall, 1898 (*Pro parte*), Trans. Wagner Inst. Sci., vol. 3, p. 685, 1903.
Ostrea megodon Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 195, pl. 18, fig. 1.
 Not *Ostrea megodon* Hanley, 1845, Proc. Zool. Soc. London, p. 106.

Shell small, crescent or sickle-shaped, rather thin except at the plicated margin where it is more or less thickened; very inequilateral, nearly equivalve. Beaks sharply pointed, very oblique. Inner margins on either side of the umbo finely crenate. Basal margin with five or six angulated folds, the three or four central much stronger than the terminal ones. Surface of valves above the plications smooth, as the plicæ do not extent towards the beak, but effect only the outer, basal, half of the crescent-shaped shell. Length 45, width 25 mm.

We have been calling the Antillean, Miocene, sickle-shaped, five to six plicated oysters, *Ostrea megodon* Hanley. Unfortunately, we have no specimens of the true *megodon*. But a study of Hanley's description of this recent Peruvian shell shows that it is analogous to, but not specifically identi-

cal with, our fossils. Hanley's type had five or six larger, anterior plications and a number of weaker posterior ones; and the length was five inches, or 127 mm.—that is, more than twice as large as our largest fossils. Moreover, Hanley gives as a most distinctive feature, the *gigantic* tooth-like folds. This would not apply to the plications of our fossils.

Mr. Olsson's figured specimen from the Central American Miocene is very much like the Trinidad *O. messor* and is, I think, the same species.

Locality.—Springvale.

Horizon.—Upper Miocene.

Ostrea messor var. *caimitica*, n. var.

Pl. 11, Fig. 3

Ostrea megodon Maury, 1917, Bull. Amer. Paleont., No. 29, p. 183, pl. 34, fig. 3.

Not *Ostrea megodon* Hanley, 1845, Proc. Zool. Soc. London, p. 106.

The specimens from the Dominican Miocene that I referred to *O. megodon*, are of the same general type as the Miocene species from Trinidad now described as *O. messor*; but have much weaker plications. The figured specimen has four in all, and they are rounded and undulate, instead of sharply angulate. The shell appears as a varietal form of *O. messor*. Length 55, width 25 mm.

Localities.—Guayubin to Mao Road; *Teredo* zone, Rio Cana at Caimito.

Horizon.—Miocene.

Ostrea messor var. *tabaquita*, n. var.

Pl. 11, Fig. 6; Pl. 12, Fig. 6

From the Tabaquite Road we have a broader, more ovate and less sickle-shaped, though curving, small, plicated oyster with stronger plications than the Springvale shell. The specimen is incomplete and lacks the smaller terminal plications. The inner margins on either side of the umbo are finely crenate for some distance. Estimated length 50, width 35 mm.

Another more ovate, curving shell, perhaps this variety though less strongly plicated, is from the blue, shaly clays above the limestone on the top of the Brasso section, No. 302. In this form the sudden change from the flat, smooth area to the conspicuously plicate border is very striking, and the inner upper margins are very neatly and markedly, closely crenate. It measures 50 x 40 mm.

O. sculpturata var. *osculum* Pilsbry and Brown from Miocene beds near Cartagena, Columbia, has only two, very deep, folds in each valve, is rounded and nearly equilateral, and its affinities are stated to be with *O. sculpturata* Conrad. I have no specimens of this Columbian form, but our Trinidad shells are not like *sculpturata*, because in that species one valve is flat and nearly smooth, or feebly plicate, and the plications on the convex valve are more numerous and less pronounced, and they extend almost to the beak—they are radial rather than marginal.

Locality.—8½ miles on the Tabaquite Road.

Horizon.—Lower Miocene, about equivalent to the Tamana horizon.

Genus *HYRIA* Lamarck

Subgenus *HYRIA* Lamarck

Hyria (Hyria) trinitaria, n. sp.

Pl. 13, Fig. 2

Shell subrhomboidal, rather solid, only slightly inflated, when perfect with a narrow, conspicuous, pointed, anterior process and a broad, high posterior dorsal wing terminating when entire in a prominent point. Posterior ridge strongly carinate, slightly biangulate. Beaks very low. Hinge line almost perfectly straight. One specimen shows distinctly a pseudo-cardinal tooth much split up into denticles. Surface marked with close, sharply defined, concentric threads, and on the disc, in front of the umbonal carina are very beautiful V-shaped markings. Length of shell without the anterior and posterior points, 65, greatest height 50, semi-

diameter 18 mm.

This shell is of great interest as being ancestral to *Hyria* (*Hyria*) *corrugata* Lamarck (pl. 13, fig. 1), the genotype, in showing the dawning of the V-shaped corrugations which are so striking in this recent species, found in the rivers of Peru, Guiana and Brazil.

The genus *Hyria* is limited to, and very characteristic of the Neotropical Province of the *Unionidæ*. There are but four species in *Hyria*, *sensu stricto*; *corrugata*, *rugosissima*, *latialata*, and *transversa*, and one in the subgenus *Triquetra* Simpson—*stevensi* Lea.

Locality.—Cedros Point, southwestern Trinidad.

Horizon.—Lower Pliocene.

Genus *PECTEN* Müller

Pecten (*Pecten*) *archon*, n. sp.

Pl. 16, Figs. 2, 3, 5

Pecten crassicardo Guppy, 1910, Agric. Soc. Trinidad and Tobago, Paper No. 440, p. 13; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 155.

Not *Pallium crassicardo* Conrad, 1856, Proc. Acad. Nat. Sci. Phila., p. 313; Arnold, 1906, U. S. Geol. Surv., Prof. Paper No. 47, p. 71, pl. 16, figs. 1, 1a, pl. 17, figs. 1, 1a, pl. 18, figs. 1, 2, 2a.

Shell large, rather sparsely, but very prominently ribbed. Right valve convex, but not extremely so; left valve flat or slightly concave. Both valves have about sixteen ribs of which the anterior and posterior three are small and closely crowded, while the ten or eleven over the center are very much larger. On the right valve they are very bold, high, squarish, and the five or six central ribs are distally medially grooved; but this character does not appear until the shell is more than half grown. Interspaces deep, very narrow proximally, but on old shells at the basal margin nearly as wide as the ribs. Both ribs and interspaces are crossed by fine growth lines. Ears equal. On the right valve the anterior ear has five coarse, equal, radiating threads, the posterior is less strongly and regularly radiately striate. Notch beneath the anterior ear rather shal-

low. A convex valve is 70 mm. in length, 62 in altitude and 20 in semidiameter. Two flat valves measure 68 x 58 and 65 x 53 mm.

This is probably the Springvale *Pecten* that Dr. Guppy referred approximately to the Californian *Pecten crassicardo* Conrad. But that is a *Lyropecten*, with both valves convex, while this is a true *Pecten*. The strong ribbing is, however, somewhat alike in the Californian and Trinidad shells.

The distinctive features by which this species is at once separated from the more abundant shells of *P. demiurgus* Dall, with which it is associated, are the dissimilar valves, and the very strong central ribs, lightly medially cleft in later stages of growth.

Locality.—Springvale.

Horizon.—Upper Miocene.

Pecten (*Plagiectenium*) *demiurgus* Dall Pl. 14, Fig. 5; Pl. 16, Fig. 6

Pecten comparilis Guppy, 1874, Geol. Mag., vol. 1, p. 451.

Not *Pecten comparilis* Tuomey and Holmes, 1855, Pleioc. Fos. S. Car., p. 29, pl. 11, figs. 6–10.

Pecten (*Plagiectenium*) *demiurgus* Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, pt. 4, p. 718, pl. 26, fig. 3.

Pecten demiurgus Guppy, 1910, Agric. Soc. Trinidad and Tobago, Paper No. 440, pp. 12, 13; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 155.

Shell large, suborbicular, somewhat oblique posteriorly. Right valve a little more inflated than the left, being noticeably fuller in the umbonal region. Otherwise, the right and left valves are similar. Ribs twenty, strong, rounded, finely squamose. Ears nearly equal, the anterior more deeply inset, with about six coarse, radial striæ and with a rather deep byssal notch beneath; posterior ear smooth above, the striations nearly obsolete, below with six or seven fine, radial threads. Altitude of type 70, latitude 72, diameter 36 mm. We have an abundance of all sizes from 17 to 75 mm. in altitude. An average-sized adult with both valves in place is 71 x 74 x 34. Splendid single valves 75 x 78 and

75 x 85 mm.

The fact that the right valve is more convex than the left indicates that this species was a very strong swimmer—for usually the left valve is the larger in this genus.

P. demiurgus is very closely related to the living west coast *P. ventricosus* Sowerby, the type of the section *Plagiectenium* Dall, to which most of the shallow water Pectens of our modern coasts belong.

Localities.—Savanetta (type locality, Guppy coll.); Springvale, very fine specimens; fragments southeast corner of E 23; 11th mile post on Caparo Road; also a doubtful cast from the top of the Brasso section.

Horizons.—Springvale Miocene; Manzanilla Miocene. and perhaps Brasso Miocene.

Pecten (Plagiectenium) gibbus Linnæus Pl. 14, Fig. 2; Pl. 16, Fig. 1

Ostrea gibba Linnæus, 1758, Syst. Nat., Ed. X, No. 172, p. 698.

Pecten gibbus Reeve, 1852, Conch. Icon., pl. 9, figs. 37b, 37c, not 37a.

Pecten gibbus d'Orbigny, 1845, In de la Sagra's Hist. Fis. Pol. y Nat.

Isla de Cuba, vol. 5, *Muliscos*, p. 362.

Pecten circularis Guppy, 1877, Paria Fauna, p. 155. Not of Sowerby.

Pecten (Plagiectenium) gibbus Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 745.

Pecten (Plagiectenium) gibbus Maury, 1920, Bull. Amer. Paleont., No. 34, p. 27.

Shell rounded, inflated, both valves convex, not very discrepant in size. Ribs nineteen to twenty-two. Length of adult shell about 40 mm.

From the dwarfed fauna of Matura we have several small, gibbous *Pecten* valves with nineteen to twenty ribs; the right valve with the interspaces more striated than those of the left, a character noted by d'Orbigny in his discussion of this species, of which these valves are probably stunted specimens. Length of right valve 20, height 22, semidiameter 7 mm.; a left valve is 20 x 20 x 6.

Dr. Guppy listed *Pecten nucleus* Born from Matura, but *vide* Dr. Dall, that has 21–23 ribs, and is recent only. However, *nucleus* is placed by Dall as a variety of *gibbus*, and it is probable that the Matura shells referred by Guppy to

nucleus were the same as ones here referred to *gibbus*.

This species first appeared in the Miocene of Virginia, is present in the Pliocene of Florida, and the Pleistocene raised Antillean beaches, and ranges in the recent fauna from Hatteras to Brazil and in the Gulf of Mexico.

Locality.—Matura.

Horizon.—Upper Pliocene.

Pecten cf. *cercadica* Maury

Pl. 16. Fig. 4

Pecten cercadica Maury, 1917, Bull. Amer. Paleont., No. 29, p. 188, pl. 34, fig. 11.

Cf. *Pecten gardneræ* Cooke, 1919, Carnegie Inst. Washington, Publ. No. 291, p. 134, pl. 7, figs. 5, 6.

There is a group of Antillean Tertiary *Pecten*s of rather small size (22 to 30 mm. in length), fan-like form, fifteen to sixteen rounded, radial ribs, smooth except for very fine concentric growth lines.

In 1917, I described a Dominican shell of this group, naming it *P. cercadica*. The type was a left valve, the only specimen in my collection, and unlike any then in the National Museum. In 1919, Dr. Cooke described from the Cuban Miocene (by error Oligocene) *P. gardneræ* and *vaughani* var. *flabellum*; and from Antiqua *P. vaughani*, of an older horizon. These three are all members of the *cercadica* group. Dr. Cooke's name *vaughani* being preoccupied, I am suggesting for it the name *kunkuma*. See discussion under that heading. The left valve of *gardneræ* is very like that of *cercadica*, which also has a tendency to the grouping of the concentric lines, although these stages are not so regularly spaced as in Dr. Cooke's shell, varying from 1½ to 3 mm. in width. The ears also appear somewhat different.

From Brasso we have two imperfect shells which may be right valves of *cercadica*. They are flat, fan-like; ribs sixteen, strong; anterior ear with six radiating riblets, the upper two decidedly scabrous, notch not very sharply angulate. Length of larger valve 31, altitude 29 mm. Specific

identification is not possible, but the valves are certainly of the *cercadica* group.

Locality.—Brasso, top of the section, No. 284.

Horizon.—Brasso Miocene.

***Pecten cercadica* var. *tabaquita*, n. var.**

Pl. 14, Fig. 1

From the fine, gray clay on the Tabaquite Road we have a right valve of the *Pecten cercadica* group; but differing from the Brasso valves in having much flatter and weaker ribbing and a very much sharper byssal notch.

This valve is compressed, somewhat oblique, delicate, with sixteen ribs that become weaker posteriorly so as to be hardly more than undulations. The ribs extend to the beak. The anterior ear is slightly the smaller and has six radiating threads, the upper being the coarser and more scabrous. Byssal notch deep, nearly, but not quite, half the length of the ear, very sharply V-shaped. The posterior ear is smooth except for fine growth lines. Length of valve 30, altitude 29 mm.

This valve resembles *P. vauhani* var. *flabellum* Cooke, but in that Cuban shell the ribs do not extend to the beak and the byssal notch is U-shaped, while in this the ribs reach the apex of the beak and the notch forms a very sharp, deep angle.

Locality.—8½ miles on the Tabaquite Road near the Tabaquite oil field.

Horizon.—Lower Miocene, about equivalent to the Tamana horizon.

***Pecten kunkuma* (new name)**

Pecten vauhani Cooke, 1919, Carnegie Institution of Washington, Publ. No. 291, p. 133, pl. 8, figs. 2, 3, 4.

Not *Pecten* (*Lyropecten*) *vauhani* Arnold, 1906, U. S. Geol. Surv., Prof. Paper No. 47, p. 81, pl. 23, figs. 3, 3a, 3b.

Dr. Cooke's name for his Anguilla *Pecten* is preoccupied by Dr. Arnold's *Pecten* from the Miocene of Ojai Valley, Ventura County, California.

For the *Anguilla* shell the Sanscrit word *kunkuma*, for crocus is suggested.

Locality.—Crocus Bay, Anguilla.

Horizon.—Oligocene.

Pecten kunkuma var. *flabellum* Cooke

Pecten vaughani var. *flabellum* Cooke, 1919, Carnegie Inst. Washington, Publ. No. 291, p. 134, pl. 8, figs. 6a, 6b, 7.

Because of the preoccupation of the name *vaughani*, Dr. Cooke's variety of *flabellum* will fall under *P. kunkuma* Maury.

Localities.—La Cruz and Santiago, Cuba.

Horizon.—Miocene.

Pecten maturensis, n. sp.

Pl. 14, Figs. 3, 4

Shell delicate, thin, obliquely suborbicular, fan-like, with both valves much flattened, the left being slightly the more convex, but their difference in form is not marked. Right valves sculptured with about sixteen very roundly and strongly fluted ribs, entirely smooth except for concentric growth lines; ears of moderate size, the anterior with six radiating threads. Left valve feebly sculptured with very low, undulating ribs marked only with growth lines. Length of a right valve 33, altitude 32, semidiameter 5; a left is 31 x 29 x 4 mm.

This species seems nearest to *Pecten thompsoni* Maury, from the Gurabo formation, Dominican Republic.

Locality.—Matura.

Horizon.—Pliocene.

Genus *AMUSIUM* (Bolten) Schumacher

Amusium papyraceum Gabb

Pleuronectia papyracea Gabb, 1873, Trans. Amer. Philos. Soc., vol. 15, p. 257.

Amusium papyraceum Dall, 1898, Trans. Wagner Inst. Sci., p. 718; 1903, p. 1586.

Amusium papyraceum Maury, 1917, Bull. Amer. Paleont., No. 29,

p. 190, pl. 26, fig. 22.

Amusium papyraceum Maury, 1920, Sci. Surv. Porto Rico and Virgin Isls., vol. 3, pt. 1, p. 21.

Amusium papyraceum Hubbard, 1921, *Idem*, pt. 2, p. 96.

Amusium papyraceum Pilsbry, 1922, Proc. Acad. Nat. Sci. Phila., vol. 73, p. 413, pl. 43, figs. 8, 9. (Gabb's type.)

In the collection are four imperfect valves, probably small specimens of Gabb's *papyraceum*. The external shell is smooth except for fine, concentric striæ, there being no nepionic ribbing at the beak; and the inner ribs are paired, their spacing being similar to that of *papyraceum*. Gabb's type was 54 in length by 52 in height; but some of our Dominican valves were about 100 mm. in altitude. Smaller Porto Rican valves measured 35 x 36. The largest Trinidad shell is 51 mm. in length.

Locality.—Shore of Manzanilla Bay.

Horizon.—Manzanilla Miocene.

Amusium rex-maris, n. sp.

Pl. 15, Fig. 1

Shell very large, thin, obliquely subcircular, moderately and evenly convex, margins gently curving. Ears rather large, subequal. Exterior surface of shell where perfect showing conspicuous concentric growth lines and occasional ridges of slower growth periods. Interior of shell with paired radial ribs, there being about fourteen pairs. At the basal margin of the valve each pair occupies three to four, and each interspace, eight to fifteen millimeters, the spacing being variable. The ribs appear only on the lower central portion of the interior of the valve, as they become obsolete towards the hinge, and are absent anteriorly and posteriorly. Length of valve 165, altitude 147, approximate semidiameter 18 mm.

The exterior of the beak is concealed by the matrix which is unfortunate, as Dr. Dall has found the umbonal sculpture of the *Amusiums* valuable in classification. Thus *A. mortoni* Ravenel, *papyraceum* Gabb, and *luna* Brown and Pilsbry, have perfectly smooth beaks, while *lyoni* Gabb, *sol* and *antiguensis* have radial ribs on the exterior of the shell

in early stages.

On comparing this splendid *Amusium* with other species having paired internal ribs, it is seen to have fewer pairs. Thus *A. mortoni* has a minimum of twenty-one, *luna* and *sol* have about twenty-three pairs each, and *papyracea* has them still more closely-set. The largest *sol* recorded measured 90 x 30 and the largest *luna* 80 x 76 mm.

In size and general aspect our Trinidad *Amusium* is most like *mortoni* Ravenel, the very large Miocene to Pliocene species, but has decidedly fewer paired ribs and instead of being nearly circular is so oblique that there is 20 mm. difference in the length of a radial line dropped from the beak to the anterior basal margin from one dropped to the posterior basal margin—the anterior measuring 120 and the posterior 140 mm.

Locality.—Springvale.

Horizon.—Upper Miocene.

Genus *PLICATULA* Lamarck

Plicatula gibbosa Lamarck

Pl. 11, Figs. 4, 5

Plicatula gibbosa Lamarck, 1801, Syst. Anim. sans Vert., p. 132.

Plicatula ramosa Lamarck, 1819, Anim. sans Vert., vol. 6, p. 184.

Plicatula vexillata Guppy, 1873, Proc. Sci. Assoc. Trinidad., vol. 2, p. 86, pl. 2, fig. 7; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 70.

Plicatula cristata Gabb, 1873, Trans. Amer. Philos. Soc., vol. 15, p. 257.

Plicatula vexillata Guppy, 1874, Geol. Mag., London, p. 436, pl. 17, fig. 7.

Plicatula gibbosa Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 763.

Plicatula gibbosa Maury, 1920, Bull. Amer. Paleont., No. 34, p. 30.

Our specimens from Trinidad have usually seven or eight plications. Like all the Matura specimens, they are small, measuring about 15 x 15 x 7 mm. They resemble small gibbosas from Florida.

Fide Dr. Dall, *P. vexillata* Guppy, from Jamaica, is identical with *gibbosa*—as one would surmise from the figure of Dr. Guppy's type.

P. gibbosa is living from Hatteras through the Antilles south to Rio de la Plata.

Locality.—Matura.

Horizon.—Pliocene.

Genus *ANOMIA* (Linnæus) Müller

Anomia simplex d'Orbigny

Pl. 12, Fig. 8

- Anomia simplex* d'Orbigny, 1845, In de la Sagra's Hist. Fiscia, Pol. y Nat. Isla de Cuba, vol. 5, *Moluscos*, p. 371, Atlas, p. 28, figs. 31-33.
Anomia ephippium Conrad, 1845, Medial Tert. Fos., p. 75, pl. 43, fig. 4.
Anomia ephippium Tuomey and Holmes, 1855, Pleioc. Fos. S. Car., p. 18, pl. 5, fig. 4; Holmes, 1858, Post-Pl. Fos. S. Car., p. 11, pl. 2, fig. 11.
Anomia simplex Guppy and Dall, 1896, Proc. U. S. Nat. Mus., vol. 19, p. 236.
Anomia simplex Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 784.
Anomia simplex Maury, 1917, Bull. Amer. Paleont., No. 29, p. 191, pl. 26, fig. 15; 1920, *Idem*, No. 34, p. 32.
Anomia simplex Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 209, pl. 21, fig. 6.

Recent specimens from Martinique and Cuba were described by d'Orbigny, the same year that Conrad described the fossil; but d'Orbigny's work was prior. The shell is smooth or concentrically striated, more or less orbicular but irregular in form because of its attached habit, diaphanous, fragile, shining, often used for ornamental shell work. Byssal aperture in the flat valve oval, large. A rounded convex valve from Trinidad is 28 mm. in length, 26 in height, 10 in semidiameter; a high, narrow specimen is 30 in length, 38 in height.

A static species, extending from the Miocene to Recent. Present range, Nova Scotia southward through the Antilles.

Localities.—Quarry $\frac{1}{2}$ mile above Brasso Station; Matura.

Horizons.—Middle Miocene; Upper Pliocene; Recent.

Anomia umbonata Guppy

- Anomia umbonata* Guppy, 1896, Proc. U. S. Nat. Mus., vol. 19, p. 325, pl. 30, fig. 6.
Anomia umbonata Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 783.
Anomia umbonata Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, p. 7; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35,

p. 150.

Shell very small, irregularly suboval, beak pointed, surface with pustules, but no radial striæ. Breadth of type 6 mm.

Locality.—Shell bed, Ally Creek, southwest of San Fernando (Guppy).

Horizon.—Ally Creek Miocene.

Genus *MYTILUS* (Linnæus) Bolten

Section *MYTILUS*, *sensu stricto*

Mytilus (*Mytilus*) *caroniensis*, n. sp.

Pl. 12, Figs. 7, 11

In the Brasso quarry, associated with *Modiolus brassoensis*, is a small *Mytilus*, shown by its smooth surface to belong to the section *Mytilus*, *sensu stricto*.

The shell is small, subtrigonal, with the beak terminal, very acute, and curving forward. The surface is polished and shows no trace of sculpture. The longest radius of the largest shell is 25, and the greatest width 21 mm.

This shell somewhat resembles small shells of *Mytilus edulis*, but is different in form, being more spreading and with a more acute and curving beak.

Locality.—Quarry $\frac{1}{2}$ mile above Brasso Station, Department of Caroni, west central Trinidad.

Horizon.—Brasso Miocene.

Genus *MODIOLUS* Lamarck

Section *MODIOLUS*, *sensu stricto*

Modiolus (*Modiolus*) *waringi*, n. sp.

Pl. 17, Fig. 1

Shell exceedingly large, elongate-oblong, very ventricose; anterior end rounded, projecting beyond the full, but low beak, posterior end broad, squarely rounded; posterior dorsal margin high, curving; posterior dorsal area compressed. Center of disc with a rather strong, radial sulcation which, however, only gently emarginates the base.

Surface of shell marked only with quite even concentric, thread-like lines of growth. Length 127, greatest height 60, diameter 45 mm.

A really magnificent shell, in size recalling *M. ducatelli* Conrad from the Maryland Miocene, but very much more inflated, less sulcate, much squarer posteriorly, and with the anterior basal margin deeper. *M. gigas* Wagner from Florida is attenuated anteriorly. This splendid shell is named in honor of Mr. Gerald A. Waring, by whom it was picked up in the quarry.

Locality.—Springvale.

Horizon.—Upper Miocene.

Modiolus (Modiolus) brassoensis, n. sp.

Pl. 12, Fig. 12

Shell rather small, narrow anteriorly, wide posteriorly, with a very prominent sulcation passing from the beak to the basal margin. Umbonal slope very rounded. Surface marked only with concentric growth lines, there being no traces of radial striations. Length 40, anterior altitude 16, posterior altitude 24, semidiameter 9 mm.

Comparison with the recent *M. tulipus* Linnæus, shows that the fossil is much more sulcate, has a much less anterior beak, and the posterior dorsal line is straight, so that the greatest height of the shell is near the posterior end instead of about the center, as in *tulipus*. Our shell is much smaller and very much more sulcate than *M. modiolus*.

Modiolus maonis Maury, from the Dominican Miocene, also belongs to the section *Modiolus*, *sensu stricto*; but is not sulcate, and is quite different in form from this Trinidad shell.

Locality.—Quarry $\frac{1}{2}$ mile above Brasso Station.

Horizon.—Brasso Miocene.

Genus *BOTULA* Moersch

Botula cinnamomea Lamarck

Modiola cinnamomea Lamarck, 1919, Anim. sans Vert., vol. 6, p. 114.
Modiolus cinnamomeus Dall, 1898, Trans. Wagner Inst. Sci., vol. 3,

p. 797.

Modiolus (Botula) cinnamomeus Cooke, 1919, Carnegie Inst. Washington, Publ. No. 291, p. 145, pl. 14, figs. 4, 5.

Botula cinnamomea Maury, 1920, Bull. Amer. Paleont., No. 34, p. 36.

Shell small, nearly smooth, subrhomboidal, slightly arcuate, inflated; beaks full and high. It may attain a length of 34 mm.

This species is quoted by Dr. Dall from the Tertiary of Trinidad; and by Cooke from that of Santiago, Cuba. In the recent fauna it extends from North Carolina through the West Indies, boring and nestling in soft limestone or shells.

From Zone H. Rio Cana at Caimito, Dominican Republic, I described *Botula hispaniolæ*, which showed very fine radial striæ. Gabb's *incurva* is from Costa Rica.

Locality.—Trinidad (Dall).

Genus *CRENELLA* Brown

Crenella divaricata d'Orbigny

Pl. 18, Fig. 13

Nuculocardia divaricata d'Orbigny, 1845, In de la Sagra's Hist. Fisica, Pol. y Nat. Isla de Cuba, vol. 5, *Moluscos*, p. 339, Atlas, pl. 27, figs. 56-59.

Crenella divaricata Gabb, 1873, Trans. Amer. Phil. Soc., vol. 15, p. 252.

Crenella divaricata Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 803.

Crenella divaricata Maury, 1917, Bull. Amer. Paleont., No. 29, p. 194, pl. 26, fig. 18; 1920, Bull. 34, p. 37.

Shell minute, ovate, very convex, sculptured with fine radiating riblets which divaricate prettily on the central part of the valve. Height of shell 4, width 3 mm. D'Orbigny's type was a recent Antillean specimen, a little over 3 mm. in size.

C. divaricata appeared in the Miocene of Santo Domingo, and of Jamaica; and in the Pliocene of Florida and Costa Rica. It is living in the West Indies, the Gulf of Mexico, and also on the Pacific coast.

Locality.—Springvale.

Horizon.—Springvale Miocene.

Genus *TEREDO* Linnæus*Teredo incrassata* Gabb

Pl. 18, Figs. 9, 10

Kuphus incrassatus Gabb, 1873, Trans. Amer. Phil. Soc., vol. 15, p. 246; 1881, Jour. Acad. Nat. Sci. Phila., new ser., vol. 8, p. 342, pl. 44, figs. 12a-e.

Teredo fistula Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 161; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 40. Not of Lea.

Teredo fistula Guppy, 1874, Geol. Mag., London, p. 441.

Teredo fistula Guppy, 1876, Quart. Jour. Geol. Soc. London, p. 529.

Teredo incrassata Dall, 1903, Trans. Wagner Inst. Sci., vol. 3, p. 1587.

Teredo fistula Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, p. 6; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 149.

Teredo incrassata Maury, 1917, Bull. Amer. Paleont., No. 29, p. 235, pl. 39, fig. 24; *Idem*, No. 30, p. 25.

Kuphus incrassatus Vaughan, 1919, Bull. U. S. Nat. Mus., No. 103, p. 558.

Teredo incrassata Maury, 1920, Sci. Surv. Porto Rico and the Virgin Islands, vol. 3, pt. 1, p. 45.

Teredo incrassata Hubbard, 1921, Sci. Surv. Porto Rico, vol. 3, pt. 2, p. 128.

We have several fragmentary, small tubes, doubtless of this Miocene species of *Teredo*, from Trinidad. No valves have ever been found, although in Santo Domingo the tubes are very common and often several feet long, but the shell itself remains unknown.

Dr. Guppy recorded similar tubes from Santo Domingo and from the Trinidad Miocene as *Teredo fistula* Lea.

Locality.—Springvale.

Horizon.—Upper Miocene.

Genus *SAXICAVA* Fleury de Bellevue*Saxicava trinitaria*, n. sp.

Pl. 18, Fig. 8

All recent *Saxicavas* of our Atlantic coast are grouped by Dr. Dall under *S. arctica* Linnæus, which is found in the Miocene of Maryland, Pliocene of Florida, and living from the Arctic Sea south to Barbados. In the Gulf of Mexico is *S. azaria* Dall, of altogether different form.

A comparison of our fossil shells with figures of *arctica* and with specimens brought by Professor Tarr from Green-

land, shows that the beak is very much more anteriorly placed in the Trinidad shell. In *arctica* it is about at the anterior third, while in our fossils it is practically terminal. Directly beneath it the anterior end of the shell is truncate. This is followed by a radial sulcation which emarginates the base. Posterior end produced, roundly truncate. Surface irregular, crude, and marked with uneven, concentric growth lines. Hinge edentulous. Length 21, altitude 9, semidiameter 5.5 mm.

In the Newcomb collection are specimens labelled *Saxicava tenuis* Sowerby, from Panama. These resemble our shells in form and in the anterior position of the beak. This west coast recent shell is the closest ally of our fossil species.

Locality.— $\frac{1}{4}$ mile south of 6th mile post on Freeport-Todd's Road.

Horizon.—Upper Miocene (*Arca patricia* level).

Genus *CORBULA* Lamarck

Section *ALOIDIS* Megerle

Corbula (Aloidis) vieta Guppy

Pl. 19, Figs. 3, 4

Corbula vieta Guppy, 1866, Quart. Jour. Geol. Soc. London, vol. 22, p. 580, pl. 26, fig. 8 (right valve).

Erycina tensa Guppy, 1866, *Idem*, p. 582, pl. 26, fig. 6 (left valve).

Corbula vieta Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 161; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 40.

Cf. *Corbula disparilis* Gabb, 1873, Trans. Amer. Philos. Soc., vol. 15, p. 247 (which may be *sancti-dominici* Maury). Not *Corbula disparilis* d'Orbigny, 1845, De la Sagra, Hist. Pol. y Nat. Isla de Cuba, pl. 27, figs. 1-4.

Corbula vieta Guppy, 1874 (in part) Geol. Mag., p. 441.

Corbula disparilis Dall, 1896, Proc. U. S. Nat. Mus., vol. 19, No. 1110, p. 329. Not of d'Orbigny.

Corbula (Aloidis) vieta Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 849.

Corbula vieta Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, p. 6; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 149.

Not *Corbula vieta* Maury, 1917, Bull. Amer. Paleont., No. 29, p. 231, pl. 39, fig. 13, which is *sancti-dominici* Maury.

From Manzanilla, the type locality, we have a number

of *Corbula* which are clearly of the same sort that Dr. Guppy had when he described *Corbula vieta*.

These shells are very small, the larger measuring five to seven millimeters in length. The right valve, represented by Guppy's figure 8 of his type, is subtrigonal, but less equilateral than in his drawing, the anterior end being a little shorter and the posterior very slightly longer. This valve is very convex and is strongly and regularly concentrically ridged, the ribs very close and fine near the beak but becoming coarser distally. About twenty-five can be counted under a lens. One right valve is the size of d'Orbigny's figure of the type of his recent species *C. disparilis*, which was 5.5 mm. long. This shell bears a decided resemblance to d'Orbigny's figure 1, but the beak is not so high and the ribbing is coarser and stronger. This coincides with Dr. Dall's conclusions. In 1896 he united *vieta* with *disparilis*, but separated them in 1898, because of constant slight differences.

The left valve of *C. vieta* has been in doubt. Dr. Dall stated that Guppy's *Erycina tensa*, figure 6 on the same plate as *C. vieta* and also from Manzanilla was the left valve of *vieta*. Mr. Olsson questioned this (Costa Rica Miocene, p. 267) because of the Veneroid form of the *Erycina tensa* and its fine, but very clear radial threads, numbering about 14.

We have several left valves which show no radials, only faint concentric lines; but several others show a number of the radial threads. One valve is very perfect and closely resembles Guppy's figure of "*Erycina tensa*," and its hinge is that of *Corbula*, not of *Erycina*. Unfortunately, the exact locality of this valve is uncertain.

Locality.—Manzanilla.

Horizon.—Lower Miocene.

Corbula (*Aloidis*) *sancti-dominici*, n. sp.

Pl. 19, Fig. 2

Corbula (*Aloidis*) *vieta* Maury, April, 1917, Bull. Amer. Paleont., pl. 39, fig. 13.

Not *Corbula vieta* Guppy, 1866, Quart. Jour. Geol. Soc. London, vol. 22, p. 580, pl. 26, fig. 8.

Corbula vieta Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 266, pl. 28, fig. 15.

Corbula vieta Maury, not Guppy, Spieker, 1922, Johns Hopkins Studies in Geol., No. 3, p. 170.

As remarked by Mr. Spieker, *loc. cit.*, my Dominican shell referred, in 1917, to *Corbula vieta* Guppy, is not identical with the typical *vieta* from Manzanilla, Trinidad.

But I am convinced that Dr. Guppy included more than one species in his Trinidad *vietas*—for those from the Caroni beds are far more unlike the Manzanilla specimens than is my Dominican shell.

In this memoir I am, therefore, restricting *Corbula vieta* Guppy to the typical form first described from Manzanilla.

On a right valve of a Manzanilla *vieta*, 6 mm. in length, 6 in height and 3 in semidiameter, about twenty-five ribs can be counted under a lens. The Dominican right valve in question measures 10 x 10 x 5 mm., and on it about twenty-six ribs can be counted. It is larger, much more inflated, and the ribs are coarser. For it I suggest the specific name *sancti-dominici*.

Mr. Olsson in comparing his Costa Rica shells referred with a question to *vieta*, concluded that they were identical with my Dominican specimens (Olsson, Bull. Amer. Paleont., No. 39, p. 267), so I here refer them to *sancti-dominici*.

Only a comparison could show whether Gabb's Dominican shells—that he erroneously referred to *disparilis* d'Orbigny, and which Dr. Pilsbry refers to *vieta*—are true *vieta* or are *sancti-dominici*.

Localities.—Bluff 2, Cercado de Mao; Zone I, Rio Cana at Caimito, Dominican Republic (type locality).

Horizons.—Miocene, Cercado formation, Dominican Republic; and Miocene, Gatun stage, Costa Rica.

***Corbula* (Aloidis) *heterogenea* Guppy**

Corbula heterogenea Guppy MS., in coll., now in U. S. Nat. Mus.

- Corbula (Aloidis) heterogenea* Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, p. 850, pl. 36, fig. 15.
Cf. *Corbula heterogenea* Guppy, 1912, Agr. Soc. Trinidad and Tobago, Paper No. 520, p. 4; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 187.
Corbula (Aloidis) heterogenea Maury, 1920, Bull. Amer. Paleont., No. 34, p. 107.

A small species, closely related to *Corbula vieta*, but specifically distinct. It differs from *vieta* in having narrower, lower, less prominent beaks, and in the greater extension of the posterior part of the shell. Length of type 9.5, altitude 8, diameter 5 mm. Length of figured type 7.5.

Cited by Dr. Dall from the Gatun beds, Panama; Bowden beds, Jamaica; Miocene and Pliocene of Florida. We have it also from Florida, and from a depth of 1241 feet in a well at Mobile, Ala., where the Chipola Miocene is encountered.

Locality. — Corosal Road *Cadulus* bed, Trinidad (Guppy).

Horizon.—Miocene. Perhaps equivalent to the Machapoorie Miocene.

Corbula (Aloidis) sancti-andreae, n. sp.

Pl. 19, Figs. 5, 6, 7

Shell small, but attaining a somewhat larger size than the Manzanilla *Corbula vieta* Guppy, from which it differs in the following respects: In the right valve of *vieta* the posterior area is rounded, not carinated; the posterior end is very short and roundly truncate, and the valve is sub-equilateral. In the right valve of this species the posterior area is very strongly carinate, the carination ending in a pointed posterior end; and in front of the carina the disc bears a pronounced radial sulcation. On the umbonal region there may be radial striæ. The left valve of *vieta* is only slightly inflated, the beak is low and smaller than that of the opposite valve; the surface is nearly smooth, with very faint concentrics and sometimes threadlike radials. In the left valve of this species (of which we have a number of specimens with both valves together) the beak is nearly as full as that of the right valve so that in early stages right and

left valves are nearly equally convex, and the left sometimes shows quite strong concentric ridges on the umbo, but later the valve becomes less inflated and smooth except for microscopic growth lines.

An adult shell with both valves together measures in length 6, in height 5, diameter 4 mm. The very largest valve is $8 \times 6.5 \times 4$.

The very convex, subequal beaks are a distinctive feature of this little shell, which in some respects resembles *heterogenea*—that shell being about the same size, or slightly larger, and also produced somewhat posteriorly.

Locality.—Manzanilla, Nos. 262, 263, 265, 294.

Horizon.—Manzanilla Miocene.

Corbula (Aloidis) isla-trinitatis, n. sp.

Pl. 19, Figs. 1, 8, 9, 10

Shell large for the genus, valves discrepant in size, form, and sculpture. The right valve is very ventricose, with a very high and full beak, strongly curved over the hinge area; anterior end very abruptly rounded, posterior end somewhat produced, obliquely truncate and biangulate; rostral carina rounded; surface sculptured with thirty-five to forty narrow, rounded, concentric, subequal ribs of which one or two usually divaricate. The ribs may cross the rostral carina but usually become weaker on the posterior area. Interspaces are very narrow, almost linear. The left valve is smaller and fits within the right, leaving quite a projecting margin of the right, especially at the posterior truncation. This valve is marked only by microscopic, concentric growth lines and by a varying number of irregularly spaced, thread-like, radial riblets of which there are usually about seven. There can be no question that this is the left valve because several specimens were preserved with the two valves together in their natural position. Length of a shell with both valves together 17, height 15, diameter 12 mm. Several separate right valves measure $19.5 \times 18 \times 11$, $19 \times 16 \times 10$, $19 \times 16 \times 9.5$ mm. A left valve is $14 \times 10 \times 4$.

This species is like a mammoth *C. vieta*. In size it is

like *C. bradleyi* Nelson from the Peruvian Miocene; but different in form, as the posterior basal margin is not obliquely produced as in Spieker's illustration of that species. Dr. Guppy placed these large *Aloidis* shells all in his *vieta*. But the difference in size is very great. The true *vieta* from Manzanilla is of the *disparilis* type, which never exceeds 9 or 10 mm., and *vieta* is smaller, reaching only 5 to 7 mm. Since this form is three or four times as large as *vieta*, it seems worthy of specific differentiation.

Corbula (Aloidis) heterogenea Guppy, is also much smaller.

Localities.—In blue shaly clay $\frac{1}{2}$ mile above Brasso Station; also Springvale.

Horizons.—Lower Springvale and Springvale Miocene.

Section *CUNEOCORBULA* (Cossmann) Dall

In the following descriptions, the section *Cuneocorbula* is used in Dr. Dall's extended sense; and not in the original, exclusive sense of its author, Monsieur Cossmann, who restricted his subgenus *Cuneocorbula* to the group of *Corbula biangulata* Deshayes. I have followed Dr. Dall, in order to give uniformity to the treatment of American species—although M. Cossmann was very strongly averse to this interpretation of his *Cuneocorbula*. (See *Révue Critique de Paléozoologie*, p. 114, Juillet, 1916.)

***Corbula (Cuneocorbula) caribæa* d'Orbigny** Pl. 20, Figs. 5, 9

Corbula caribæa d'Orbigny, 1845, In de la Sagra's Hist. Pol. y Nat. Isla de Cuba, pt. 2, vol. 5, *Moluscos*, p. 323, Atlas, pl. 27, figs. 5–8.
Corbula caribæa Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 161; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 40.
Corbula caribæa Guppy, 1874, Geol. Mag., London, 2d ser., vol. 1, p. 441.

Shell rather small for the genus, ovate-oblong, inflated, rather thick; both valves sculptured similarly with closely set, concentric, fine ridges—sometimes a little coarser, sometimes almost obsolete; both valves with an umbonal carina-

tion; posterior end, especially of the right valve, a little produced and pointed. The type was somewhat over 9 mm. in length; d'Orbigny's specimens were from the recent of Havana and Santo Domingo.

We have a great number of these shells, dredged by Professor Harris from the Gulf of Paria. The largest, a right valve, is 11 mm. in length, altitude 7, semidiameter 4. The average adult length is about 9; very young shells are only 3 or 4 mm.

Corbula caribæa d'Orbigny and *C. swiftiana* Adams (Contr. Conch., 12, p. 236, 1852) are closely allied, perhaps identical. If so, d'Orbigny's name has priority.

Localities.—Gulf of Paria, Trinidad (very abundant large and small); one mile below Matura, and Matura (young, small valves).

Horizons.—Upper Pliocene and Recent.

Corbula caribæa var. *pergrata*, n. var.

Pl. 20, Fig. 8

From Brighton we have a single right valve of a *Corbula*, resembling in form large specimens of *C. caribæa* d'Orbigny, dredged from the Gulf of Paria. But on comparing it with hundreds of valves of that species it is seen to differ in sculpture, being much more sharply, regularly, and elegantly concentrically sculptured.

Unlike the very small, dwarfed valves of *C. caribæa* from the Matura Pliocene, this shell is large for the species. Length 11, altitude 7.5, semidiameter 2.5 mm.

Locality.—Brighton shore, in pitch sand containing Mollusca.

Horizon.—Pliocene.

Corbula (Cuneocorbula) cubaniana d'Orbigny Pl. 20, Figs. 2, 3, 4

Corbula cubaniana d'Orbigny, 1845, In de la Sagra's Hist. Fisica, Pol. y Nat. Isla de Cuba, p. 322, Atlas, pl. 26, figs. 51–54.

Corbula cubaniana Guppy, 1867, Proc. Sci. Assoc. Trinidad, p. 161; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 40.

Corbula cubaniana Guppy, 1874, Geol. Mag., London, p. 441.

Shell ovate, subequivalve, white, opaque, concentrically ribbed; anterior end short rounded, posterior acutely carinate and obliquely truncate. The type was over 11 mm. in length. Recent from Havana.

In our Matura collection are a number of *Corbulas* much like d'Orbigny's *C. cubaniana*, except that they are smaller, our largest shell measuring 8 x 6 mm. Both valves are similarly sculptured and nearly alike in form, the left seemingly being a little less high.

These Pliocene shells also have some resemblance to Gabb's Dominican, Miocene specimen, described and figured by Pilsbry as *Corbula knoxiana fossilis* (Proc. Acad. Nat. Sci. Phila., vol. 73, p. 427, pl. 46, fig. 14, 1922), which differs from *knoxiana* only in having a less marked carina. For description of *knoxiana* see C. B. Adams, Contr. to Conch., No. 12, p. 238, 1852).

Locality.—Matura.

Horizon.—Pliocene.

***Corbula (Cuneocorbula) daphnis*, n. sp.**

Pl. 20, Figs. 10, 11

From Matura, eastern Trinidad, we have two left valves of a *Corbula*, differing in sculpture from our other *Corbulas*, and seemingly unlike any of Adams' unfigured, living Jamaican species.

The shell is of medium size, transversely ovate, subequilateral, evenly and moderately inflated, rounded anteriorly, pointed posteriorly; beak low; the posterior area lying between a rostral and a dorsal marginal carina, neither very marked. Radial sculpture absent. Concentric sculpture faint, so that the surface except under a lens appears almost smooth. The riblets number about twenty-six, and near the base is a strong, concentric furrow, probably peculiar to this particular valve. Length 14, height 8, semidiameter 4 mm.

A smooth, neat, regular species.

Locality.—Matura.

Horizon.—Pliocene.

Corbula (Cuneocorbula) sericea Dall

Corbula (Cuneocorbula) sericea Dall, 1898, Trans. Wagner. Inst. Sci., vol. 3, p. 848, pl. 36, fig. 8.

A short, high, very small species with a very pronounced sulcation in front of the carina. Sculpture of very fine, numerous, concentric riblets crossed by fine radial striae. Both valves similarly sculptured. Length 4.5, altitude 3.5, diameter 2.3 mm. The largest measured 5.4 x 4 mm. Type locality, Bowden, Jamaica.

This species resembles in the radial striations d'Orbigny's recent Antillean shell *Corbula lavalleana*; but is shorter and higher, and bears the strong sulcation in front of the carina which is not present in the living species.

Another species of the *Corbula lavalleana-sericea* group is the Dominican Miocene *C. cercadica* Maury, which is proportionately longer than *sericea* and lacks the sulcation anterior to the umbonal ridge. It also shows faint radial striae.

Dr. Dall's placing *Corbula cubaniana* Guppy (Geol. Mag., 1874, p. 441) in the synonymy of *sericea* is erroneous, because Guppy listed *cubaniana* from Matura, and our specimens from that locality are very unlike *sericea* but greatly resemble *C. cubaniana* d'Orbigny.

Locality.—Bowden, Jamaica.

Horizon.—Middle Miocene.

Corbula (Cuneocorbula) manzanillensis, n. sp.

Pl. 20, Figs. 6, 7

Shell minute, ovately triangular, convex anteriorly; compressed, sulcate, carinate, flexed and truncate posteriorly; basal margin convexly rounded anteriorly, slightly concave in front of the carina. The right valve has the beak smooth, followed by an area with widely-spaced, sharp, concentric riblets, later stages with closer riblets. Riblets in all numbering ten to twelve. There is also a delicate, but sharply defined radial sculpture of microscopic threads, well marked in the interspaces. The left valve of the same specimen is smaller, fitting within the right, leaving quite

a margin. In form the left valve is less inflated, except the beak which is subequal to that of the right. The anterior end is rounded, posterior truncate. The sculpture is similar to that of the right, but not so bold. The smooth beak is followed by six or seven very narrow, concentric ridges, with wide interspaces, and many microscopic, radial threads. Length of specimen with both valves in place 3.5, altitude 2.8, diameter 2.5 mm. The largest right valve is 5 x 3 mm. Many are 2 x 3.

This little shell is very common in the Manzanilla Bay beds. It resembles in general form and type of concentric ribbing, *Corbula whitfieldi* Dall, from the Oak Grove Miocene of Florida; but that is a larger shell and has no trace of radial sculpture. In the presence of radials, the Trinidad shell recalls *Corbula barrattiana* C. B. Adams, which is allied to Dr. Dall's *whitfieldi*.

Locality.—Manzanilla Bay Nos. 267, 268, 175 feet above, and 100 feet below the conglomerate.

Horizon.—Manzanilla Miocene.

Corbula (*Cuneocorbula*) *hexagonella*, n. sp.

Pl. 20, Fig. 1

Shell very small, trigonal, convex. Left valve inflated anteriorly, subcompressed posteriorly, almost equilateral, but, while the anterior end is evenly rounded, the posterior end terminates in two rounded points, of which the lower is the more prominent. These points are the terminations of the two carinæ which border the margins of the posterior area. Between them is a sulcus which is arcuate at its termination, thus with the two projecting ridges making the little shell minutely birostrate. The surface is divisible into three areas: The smooth umbonal region; the central area which is sculptured with about sixteen closely set, flattish, band-like concentric riblets; and the smooth, basal region which occupies about one-third of the height of the shell, over which the riblets become obsolete. The earlier half of this left valve is marked by about five irregularly spaced, impressed radial lines of unequal lengths. Length of

valve 6, altitude 5, semidiameter 2.5 mm.

There are a few other left valves which resemble this valve in the character of the concentric ribs, but they have not the smooth, basal area, nor the birostrate end. It is doubtful whether they are the same species. There is also a broken right valve which resembles the left valve described above as the type of *hexagonella*, in the radial impressed lines, and in the character of the ribbing, except that the ribs do not become obsolete basally. I think it is the same species. If, so, the valves are subequal, and similarly sculptured, and the species belongs to the section *Cuneocorbula*.

Locality.—Manzanilla.

Horizon.—Lower Miocene.

Corbula (*Cuneocorbula*) *brassoensis*, n. sp.

Pl. 20, Fig. 12

Shell small, transversely ovate, very markedly pointed and twisted posteriorly, strongly carinate, with a pronounced sulcus in front of the carina; basal margin strongly arcuate at the termination of the sulcation; posterior margin truncate; beaks low, subequal. Right valve a little the larger, but less strongly sculptured; the umbonal region is nearly smooth, and over the lower part of the disc are about seven rather unequal and unevenly-spaced concentric ridges. Left valve slightly smaller, but more boldly sculptured, with about ten unequal, concentric ridges; in form it resembles the right. Neither valve has any trace of radials. Length of shell with both valves together 6, altitude 4, diameter 3 mm.

This little species is at once differentiated from our other Trinidad Corbulas by its very pointed and twisted posterior end. It is like *sarda* Dall, in having the sculpture stronger on the left than on the right valve.

Locality.— $\frac{1}{2}$ mile above Brasso Station, No. 302.

Horizon.—Lower Springvale Miocene.

Corbula (Cuneocorbula) helenæ Maury

Pl. 20, Fig. 15

Corbula (Cuneocorbula) helenæ Maury, 1912, Contribution Paleont. Trinidad, Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 15, p. 62, pl. 9, fig. 25.

Shell small, sub-equilateral, nearly equivalve; oblong-ovate, carinate and truncate posteriorly; beaks low, approximate; concentric sculpture on both valves of numerous, closely-set, feeble and more or less obsolete ribs; radial sculpture, especially on the left valve, of fine, close striations, extending from the beak to the lower margin, and most conspicuously developed on the third of the disc in front of the carina. Length 8, height 5, diameter 3 mm.

This species is most like *Corbula brassoensis* in our present collection from Trinidad, but is larger and more inflated than that shell, and is further differentiated from it by the radial sculpture of *C. helenæ*, which is entirely lacking in *brassoensis*.

Locality.—Brighton, southwestern Trinidad, 1000 feet west of the pier in an impure asphalt.

Horizon.—Pliocene.

Section **BOTHROCORBULA** Gabb**Corbula (Bothrocorbula) viminea** Guppy

Pl. 19, Fig. 19

Corbula viminea Guppy, 1866, Quart. Jour. Geol. Soc. London, vol. 22, p. 293, pl. 18, fig. 11.

Corbula viminea Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 161; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 40.

Bothrocorbula viminea Gabb, 1873, Trans. Amer. Philos. Soc., vol. 15, p. 247.

Corbula viminea Guppy, 1874, Geol. Mag., London, p. 441.

Corbula viminea Guppy, 1876, Quart. Jour. Geol. Soc., vol. 32, p. 529.

Corbula (Bothrocorbula) viminea Dall, 1898, Trans. Wagner Inst. Sci., vol. 3, pt. 4, p. 850.

Not *Corbula viminea* Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, pp. 6, 13; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, pp. 149, 155.

Corbula (Bothrocorbula) viminea Maury, 1917, Bull. Amer. Paleont., No. 29, p. 233, pl. 29, figs. 20, 21.

Corbula viminea Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 270, pl. 28, fig. 25.

Shell rather large, solid, transversely oblong, rounded anteriorly, acutely beaked posteriorly; sculpture of stout, roundish, concentric ribs; hinge with a prominent cardinal tooth and a deep, orbicular pit in front of it. Guppy's type was from Bowden, Jamaica. His drawing measures 20 x 14 mm., and was, perhaps, slightly enlarged, as our Dominican specimens measure about 16 x 10.5 and Gatun shells 15 x 10.

Gabb, on finding Guppy's Jamaican species in Santo Domingo, made it the type of a new genus, *Bothrocorbula*. But the lunular pit is not constant in related forms which grade into *Cuneocorbula*, so that *Bothrocorbula* has been classed as a section instead of a genus.

In 1898, Dr. Dall questioned whether the Peruvian Miocene *Corbula bradleyi* Nelson might not be identical with *C. viminea*. But Nelson's shell has recently been figured by Spieker, which shows it to be in form very unlike *viminea*.

C. viminea was erroneously identified by Dr. Guppy from Springvale. His specimen is not *viminea*, but is the large *Aloidis* that I have called *A. isla-trinitatis*. True *Bothrocorbula viminea* has never been found in Trinidad.

Localities.—Cercado formation, Dominican Republic; Bowden beds, Jamaica; Gatun stage of Costa Rica.

Horizons.—Lower and Middle Miocene.

Corbula (Bothrocorbula) smithiana Maury

Pl. 20, Fig. 18

Corbula (Bothrocorbula) smithiana Maury, 1912, Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 15, p. 63, pl. 9, figs. 29, 30.

Shell small for this section, nearly equilateral, solid, ovate, carinate and pointed posteriorly; beaks low and small; sculpture of about twelve narrow, concentric, rather sharply edged ribs with wider interspaces, extending from the base to a short distance below the beaks which are nearly smooth. Length of left valve 8.5, semidiameter 3 mm. A lunular pit is present.

This species is smaller, much more closely ribbed than *C. viminea*, and the ribs are sharp, not rounded, as in that

species.

Locality.—Brighton, 1000 feet west of the pier in an impure asphalt.

Horizon.—Pliocene.

***Corbula (Bothrocorbula) guaiconensis*, n. sp.** Pl. 19, Figs. 13, 14, 18

Shell of medium size, solid, ovately oblong, pointed posteriorly, valves similarly sculptured and subequal, the left being only slightly smaller and shorter than the right; beaks moderately elevated, small; anterior end rounded, posterior pointed, with a rostral carina in front of which the base is slightly emarginate; sculpture of strong, rounded undulations, numbering about seven, ending at the carina, not extending upon the umbones, and strongest basally. Interspaces narrower than the ribs. Rostral area concentrically striated. Surface, where perfect, shows fine concentric growth lines and microscopic, radial striæ. Lunular area ill-defined, not forming a cavity, or cellule, and thus approaching *Cuneocorbula*. Length of shell 13, altitude 9, diameter 7 mm.

An affinity of this species is *Bothrocorbula radiatula* Dall, but that shell is at once differentiated by the presence of a conspicuous lunular cellule directly in front of the beak. Our shell also resembles the much larger Gatun species, *C. hexacyma* Brown and Pilsbry.

Localities.—Guaico-Tamana Road at 13th mile post; Fossil Ravine (central Trinidad); Machapoorie quarry.

Horizon.—Machapoorie Miocene.

***Corbula (Bothrocorbula) cistellula*, n. sp.**

Pl. 19, Fig. 20

Shell of moderate size, very solid, oblong, trigonal, subequilateral, coarsely and sparsely ribbed, posterior end pointed, basal margin arcuate; basal regions of both valves broadly and equally flattened and at right angles to their earlier growth, so that the margins come together like those of a little chest, and the diameter at the base is equal

to the greatest diameter of the shell. The right valve is slightly the larger and has two very coarse and two much weaker concentric ribs. The left valve shows one strong basal rib and traces of a smaller above it. Interior of the valves concealed but there is no indication of a cellular pit. Length of shell with both valves together 14, altitude 8, diameter 7 mm.

A very striking form. The flattened base resembles that of a shell of *viminea* from Santo Domingo (Bull 29, pl. 39, fig. 21) which I thought pathologic. But this shell has not the form of *viminea*, shows no trace of the cellule, and has fewer ribs.

This peculiar growth of the valves at maturity at right angles to their former plane takes place also, to a less abrupt degree, in *Corbula dietziana* C. B. Adams; but this species in other respects is not like this Trinidad shell.

Locality.—Fossil Ravine (central Trinidad).

Horizon.—Machapoorie Miocene.

***Corbula (Bothrocorbula) arionis*, n. sp.** Pl. 19, Figs. 11, 12, 17

Shell rather small, ovately-trigonal, irregular in form; right valve with the anterior end produced, rounded, longer than the pointed posterior end; basal margin ascending posteriorly as though the shell were pinched toward the tip. Surface marked by fine, close, concentric lines seen only with a lens, and by about three coarse, rounded, concentric ridges, bounding growth areas, each of which is at a different plane from the earlier. These areas constitute the umbonal, central, and basal parts of the valve. Hinge concealed, length of right valve 11, height 7.5, semidiameter 5 mm.

There are two more left valves probably belonging to this species, since they also have the few, irregular, heavy ridges with wide areas between them. These valves are smaller, measuring 9.5 x 6 x 2.5 and 10 x 6 x 2.5 mm.

A clumsy little shell, quite unlike our other *Corbula*s.

Locality.—Matura.

Horizon.—Upper Pliocene.

Corbula (*Bothrocorbula*) *dianæ*, n. sp.

Pl. 19, Figs. 15, 16

Shell of medium size for the genus, solid, nearly equilateral, very shortly pointed behind, posterior area with a single carina, base slightly arcuate. Right and left valves subequal, the right a trifle higher and longer; beaks nearly equal, full, not high, their apices small, acute. Sculpture on right valve of eight or nine rather coarse, rounded, concentric ribs with narrower interspaces; on crossing the carina the ribs break up into coarse striations. The upper part of all the valves is eroded, but the beaks are smooth and the later umbonal region weakly sculptured, so that the ribbing was present chiefly on the lower two-thirds of the shell. The interior of a right valve shows prominent scars, a small pallial sinus, and a strong cardinal tooth; the lunular area is hardly impressed, and does not form a cellule in front of the cardinal. Left valve with traces of about eleven ribs, being somewhat more finely and closely ribbed than the right. No radial sculpture is present. A shell with both valves together measures in length 12, altitude 10, diameter 7.5 mm. A large, single, right valve is 14 x 11.

This species has somewhat the form and hinge characters of *Corbula* (*Bothrocorbula*) *synarmostes* Dall, from the Chipola Miocene, Florida; but the base is not nearly so arcuate and the ribbing is finer in the Trinidad shell—which approaches more nearly to *Cuneocorbula*.

Locality.—Brasso Valley.

Horizon.—Machapoorie Miocene, since the strata at this locality lie below the Manzanilla beds.

Genus *MACTRA* (Linnæus) Lamarck

Subgenus *MACTROTOMA* Dall

Section *MICROMACTRA* Dall

Mactra (Micromactra) macescens Guppy

Pl. 21, Fig. 1

Mactrinula macescens Guppy, 1866, Quart. Jour. Geol. Soc., London, vol. 22, p. 581, pl. 26, figs. 2, 2a, 2b.

Mactrinula macescens Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 161; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 40.

Mactrinula macescens Guppy, 1874, Geol. Mag., London, p. 441.

Mactra (Micromactra) macescens Dall, 1898, Trans. Wagner. Inst. Sci., vol. 3, p. 894.

Shell small for the genus, thin, oblong-trigonal, compressed; posterior dorsal area smooth, marked off on both valves by a single, sharp, narrow, radial ridge, passing from the beak to the posterior basal margin; beaks very small, low, strongly concentrically undulated with rounded ripples which extend from the anterior of the shell to the posterior radial ridge. The rippling varies in different individuals but tends to become obsolete over the lower half of the valve, especially centrally. Hinge as shown by Guppy's figures 2a, 2b. Length 42, altitude 26, semidiameter 7 mm.

This species is much more strongly undulated, but in its dentition resembles *M. undula* Dall, from the Florida Pliocene. Both are allied to the recent, west coast, *M. californica* Conrad, the type of the section *Micromactra*.

In general external appearance this curious and striking species from Manzanilla bears a marked resemblance to *Mactra (Harvella) reevesi* Gray (Reeve, pl. 17, fig. 92) from Malacca, Malay Peninsula; but *Harvella* belongs to the subgenus *Mactrella*, while *fide* Dall, *macescens* belongs in the section *Micromactra* of the subgenus *Mactrotoma*. Dr. Guppy, however, placed *macescens* in the section *Mactrinula* allied to *Harvella* and in the subgenus *Mactrella*.

Locality.—Manzanilla.

Horizon.—Manzanilla Miocene.

Subgenus **MACTRELLA** Gray

Mactra (Mactrella) alata Spengler

Pl. 21, Fig. 3

Mactra alata Spengler, 1802, Skriv. Nat. Selsk., vol. 5, pt. 2, p. 99.

- Mactrella alata* Gabb, 1873, Trans. Amer. Phil. Soc., vol. 15, p. 248.
Mactra (*Mactrella*) cf. *alata* Maury, 1917, Bull. Amer. Paleont., No. 29, p. 231.
Mactra (*Mactrella*) *alata* Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 263, pl. 28, fig. 3.

This large, handsome *Mactra* is quickly recognized by its thin, inflated form, and very sharp, posterior carina. It is the type of the subgenus *Mactrella*. A Trinidad shell is 80 in length, 58 in altitude and 19 mm. in semidiameter.

M. alata is found in the Lower Miocene, Cercado formation, Dominican Republic; Middle Miocene, Gatun stage, of Costa Rica; and living on sandy shores of Porto Rico, Trinidad, and the Caribbean side of the Isthmus.

Locality.—Matura Bay, east coast of Trinidad.

Horizon.—Recent.

Section *HARVELLA* Gray

Mactra (*Harvella*) *sancti-blasii*, n. sp.

Pl. 21, Fig. 2

We have a single cast of a shell apparently a *Harvella*. The substance is entirely gone but presumably was exceedingly thin and delicate. The form is roundly trigonal. The surface is very evenly and handsomely sculptured with concentric waves which terminate abruptly at the sharp radial carina bordering the posterior dorsal area. Beaks small, acute, prosogyrate, curving over the small, impressed, cordate lunule. Escutcheon narrow and smooth. Hinge characters not known. Length 35, altitude 34, semidiameter 8.5 mm.

This species has a higher, narrower form than either *Mactra* (*Harvella*) *estrellana* or *H. sincola* Olsson, from the Costa Rican Miocene. The Trinidad shell approaches rather nearer to the recent *Harvella elegans* Sowerby (type of the section) in its general aspect.

Locality.—St. Blaise Ravine, near the south coast of Trinidad. Fossils exceedingly scarce.

Horizon.—About equivalent to the Manzanilla Miocene.

These are the Moruga beds. Same horizon is at La Luna Point.

Genus *SOLEN* Linnæus

Subgenus *SOLENA* Moersch

Solen (Solena) obliquus Spengler

Pl. 18, Fig. 12

Solen obliqua Spengler, 1794.

Solen (Solena) obliqua Dall, 1899, Proc. U. S. Nat. Mus., vol. 22, p. 107.

Solen (Solena) obliquus Dall, 1900, Trans. Wagner Inst. Sci., vol. 3, p. 954.

Solen (Solena) obliquus Maury, 1917, Bull. Amer. Paleont., No. 29, p. 230.

This species is found living in the Antilles, as at Cuba, Porto Rico and St. Thomas; and we collected fine specimens on the Monte Cristi beach, Dominican Republic. We also obtained a fragment from the Miocene at Caimito.

In the Trinidad collection is a single shell which appears to be a small valve of this species. It measures in length 35, altitude 13, semidiameter 4 mm.

The generic name of the razor-shell or spout-shell, *Solen*, is masculine, derived from the Greek word meaning a snout or gutter.

Locality.—Matura.

Horizon.—Upper Pliocene.

Genus *DONAX* Linnæus

Donax fabagelloides Guppy

Donax fabagella Guppy, 1864, Trans. Sci. Assoc. Trinidad, p. 36; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 16. Not of Lamarck.

Donax fabagelloides Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, pp. 162, 173; Harris' Reprint, 1921, Bull. 35, pp. 189, 200.

Donax fabagelloides Guppy, 1874, Geol. Mag., London, p. 435, pl. 18, fig. 10.

Donax fabagelloides Dall, 1900, Trans. Wagner Inst. Sci., vol. 3, p. 968.

An oblong, subequilateral, species zoned with broad

dark bands, and finely radiately striate. Resembling *fabagella* Lamarek, but more equilateral and proportionately not so high. It is also akin to *Donax æquilibrata* Dall, from the Miocene of North Carolina, but that is more attenuated and angulated posteriorly.

Locality.—Matura (Guppy).

Horizon.—Pliocene.

***Donax striata* Linnæus**

Donax striata Linnæus, 1767, Syst. Nat., ed. XII, p. 1127.

Donax striata Guppy, 1864, Trans. Sci. Assoc. Trinidad, p. 36; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 16.

Donax striata Guppy, 1867, Proc. Sci. Assoc. Trinidad. pt. 3, p. 162; Harris' Reprint, 1921, Bull. 35, p. 41.

Donax striata Dall, 1900, Trans. Wagner Inst. Sci., vol. 3, p. 968.

This species is now living in the Antilles and also occurs as a fossil.

Locality.—Matura (Guppy).

Horizon.—Pliocene.

***Donax couvana*, n. sp.**

Pl. 20, Fig. 19

Shell of medium size, rather thin, apparently nearly smooth when the surface was fresh; but faint radial striæ are seen near the center of the disc under a lens, and striations show beneath the abraded surface. Anterior end long, produced and narrowed, rounded at its termination: anterior dorsal margin sloping. Posterior end short, the posterior dorsal margin sloping and forming with the anterior dorsal margin an angle of about 120 degrees. Length of shell 25, altitude 15, semidiameter 5.5 mm.

This shell was in an entirely new fossiliferous locality, the deposit being a greenish blue, decayed, conglomerate. Associated with the *Donax* were *Arca* (*Noëtia*) *mundonuevensis* and *Noëtia mayensis*.

Locality.—Junction of Mayo and Couva main roads.

Horizon.—Brasso Miocene.

Genus *SANGUINOLARIA* Lamarck*Sanguinolaria unioides* Guppy

Sanguinolaria unioides Guppy, 1896, Proc. U. S. Nat. Mus., vol. 19, No. 1110, p. 327, pl. 30, fig. 11.

Original description.—"Ovate-oblong, slightly ventricose, smooth, with shallow concentric sulci and fine radiating striæ. Length 63, height 44 mm."

Dr. Guppy remarked that this was a somewhat *Unio*-like shell of uncertain affinities.

We have nothing answering to the description of this species.

Locality.—Tertiary beds, Savana Grande, Trinidad (Guppy).

Genus *SEMELE* Schumacher*Semele proficua* Pulteney

Pl. 21, Fig. 5

Tellina proficua Pulteney, 1799, Hutch. Dorset., p. 29, pl. 5, fig. 4.

Amphidesma orbiculata Say, 1822, Jour. Acad. Nat. Sci. Phila., vol. 2, p. 307.

Amphidesma orbiculata Tuomey and Holmes, 1856, Pleioc. Fos. Car., p. 94, pl. 23, fig. 4.

Amphidesma radiata (Chemn.) Reeve, 1853, *Amphidesma*, pl. 5, fig. 29.

Semele proficua Dall, 1900, Trans. Wagner Inst. Sci., vol. 3, p. 991.

This species is found in the Pliocene of Florida and ranges in the recent fauna from southern United States to Brazil and through the Antilles.

Locality.—Barbados, on the beach west of Bridgetown; also Erin Point, Trinidad.

Horizon.—Recent.

Semele purpurascens Gmelin

Pl. 20, Fig. 17

Venus purpurascens Gmelin, 1792, Syst. Nat., 6, p. 3288.

Tellina obliqua Wood, 1815, Gen. Conch., p. 152, pl. 41, figs. 4, 5.

Amphidesma variegata Lamarck, 1818, Anim. sans Vert., vol. 5, p. 490.

Amphidesma obliqua Reeve, 1853, Conch. Icon., *Amphidesma*, pl. 1, figs. 5a, 5b.

Semele variegata Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 162; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 41.

Semele variegata Guppy, 1874, Geol. Mag., London, p. 441.

Semele purpurascens Dall, 1900, Trans. Wagner Inst. Sci., vol. 3, p. 993.

Semele purpurascens Maury, 1920, Bull. Amer. Paleont., No. 34, p. 90.

A marked character of this species is the presence, on the anterior and central part of the shell, of fine ridges, passing a little obliquely across the concentric growth lines. The living shell is purplish-white, maculated with fawn. It attains about 40 mm. in length and 30 in height.

This species first appeared in the Pliocene of Florida and Costa Rica, and is now living from North Carolina to Rio de Janeiro. It was listed by Guppy from Matura (as *variegata*).

Semele proficua Pulteney [= *Amphidesma reticulata* (Chemnitz) d'Orbigny] may also be found in the recent and Pliocene of Trinidad, since it ranges southward to Brazil; likewise the handsome, small species, *Semele bellastrata* Conrad, which is Pliocene to Recent, and ranges from Hatteras to Cape San Roque, Brazil.

Locality.—Matura (Guppy).

Horizon.—Pliocene.

Semele claytoni var. *couvensis*, n. var.

Pl. 21, Fig. 4

From Trinidad we have a single imperfect specimen of a *Semele* of the same form as *S. claytoni* Maury (Bull. Amer. Paleont., No. 29, p. 227, pl. 35, fig. 9) from the Dominican Miocene, and with the concentric lamellæ similarly spaced. The sculpture is rougher and less perfectly regular than in the Dominican shell, although this may be partly due to uneven wearing. But the most important point of difference is the presence on the Trinidad shell of microscopic radial striæ, which, especially on the younger half of the valve, extend from the crest of each ridge across the interspace to the point of origin of the next lamella. The radii seem also to have slightly crenulated the edges of the lamellæ. Estimated length 63, estimated height 50, diameter 20 mm.

Semele claytoni Maury, was described from the Cer-

cado formation of the Lower Miocene of Rio Cana at Caimito; and was later identified by Mr. Olsson from the Uscari stage of Costa Rica, which is also Lower Miocene. Thus the typical form is older than this variety.

Locality.—Springvale.

Horizon.—Upper Miocene.

Genus *TELLINA* (Linnæus) Lamarck

Tellina caroniana, n. sp.

Pl. 20, Fig. 20

Tellina strophia Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, p. 12; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 155.

Not *Tellina strophia* Dall, 1900, Trans. Wagner. Inst. Sci., vol. 3, p. 1019, pl. 47, fig. 11.

Shell narrowly elongate, nearly equilateral, with extremely low beaks; posterior slope bicarinate with a sulcation between the ridges, posterior end bluntly pointed. Entire surface sculptured with subequal, very closely-set, thin, slightly raised, concentric lamellæ, which become much coarser on the posterior dorsal area. Lunule very narrow. Length of shell 65, altitude 26, semidiameter 5 mm.

This species is of the general type of *Tellina strophia* Dall, from the Miocene of Florida, but differs in form and in details of sculpture. It is also akin to *Tellina rovala* Olsson, from the Gatun stage of Costa Rica, but that is a smaller form, attaining only half the size and is more elegant in its sculpture—the posterior concentric lamellæ being arranged in two series divided by a radial groove, and the shell is more constricted and pointed posteriorly.

Locality.—Springvale.

Horizon.—Upper Miocene.

Tellina waringi, n. sp.

Pl. 20, Fig. 14

Shell small, thin and fragile, nearly equilateral, compressed. Surface smooth except for very fine concentric growth lines. Interior concealed by the matrix. Under

the lens and in certain lights the surface shows a very beautiful iridescence, such as is seen in some of the living members of the genus—as for example, in *Tellina iris*, so named from its delicate, prismatic, rainbow hues. At first thought, it seems remarkable that our shell should have retained this character, which one would think so evanescent, but it is doubtless due to the nature of the shell substance, causing the prismatic diffraction of light. Length 22, altitude 14, semidiameter 4 mm.

This species was found in a new and interesting fossiliferous bed of decayed, greenish blue, conglomerate. Associated with it were *Arca* (*Noëtia*) *mundonuevensis*; *N. mayensis*, and *Donax couvare*. Presumably the age is about equivalent to the Brasso.

This pretty, delicate, iridescent *Tellina* is dedicated to Mr. Gerald A. Waring, as a token of appreciation of his unfailing helpfulness and interest in the collection of the Trinidad fossils.

Locality.—Junction of Mayo and Couva main roads.

Horizon.—Brasso Miocene.

Genus *STRIGILLA* Turton

Strigilla pisiformis Linnæus

Pl. 20, Fig. 13

Tellina pisiformis Linnæus, 1758, *Syst. Nat.*, ed. X, p. 677.

Cardium discors Montagu, 1803, *Test. Brit.*, p. 84.

Strigilla carnaria Guppy, 1864, *Trans. Sci. Assoc. Trinidad*, p. 36; Harris' Reprint, 1921, *Bull. Amer. Paleont.*, No. 35, p. 16. Not *carnaria* Linnæus.

Strigilla carnaria Guppy, 1867, *Proc. Sci. Assoc. Trinidad*, p. 162; Harris' Reprint, 1921, *Bull.* 35, p. 41.

Strigilla carnaria Guppy, 1874, *Geol. Mag.*, London, p. 441.

Strigilla pisiformis Dall, 1900, *Trans. Wagner Inst. Sci.*, vol. 3, p. 1039; 1903, *Idem*, p. 1587.

After examining Dr. Guppy's specimens of *Strigilla* from Trinidad, and from Bowden, Dr. Dall pronounced them all identical with *S. pisiformis* Linnæus. This species extends from the Miocene up and is in the recent fauna throughout the West Indies, ranging as far north as Cape

Hatteras.

This pretty species is represented in our collection. The largest measures in length 10, height 10, semidiameter 3 mm., smaller are only 6 x 6. The entire surface is very finely and beautifully marked with undulating and V-shaped delicate groovings.

Locality.—Matura.

Horizon.—Pliocene.

Genus *METIS* H. and A. Adams

Metis trinitaria Dall

Pl. 22, Figs. 1, 2, 8

Tellina biplicata Guppy, 1866, Quart. Jour. Geol. Soc. London, vol. 22, p. 588; 1867, Proc. Sci. Assoc. Trinidad, p. 161; 1874, Geol. Mag., London, p. 441; 1876, Quart. Jour. Geol. Soc. London, vol. 32, p. 530.

Not *Tellina biplicata* Conrad, 1834, Jour. Acad. Nat. Sci. Phila., vol. 7, p. 152.

Tellina sagræ Guppy and Dall, 1896, Proc. U. S. Nat. Mus., vol. 19, p. 329.

Cf. *Tellina sagræ* d'Orbigny, 1855, Paleontologia Cubana, pl. 4, figs. 8, 9, 10.

Metis trinitaria Dall, 1900, Trans. Wagner Inst. Sci., vol. 3, pt. 5, p. 1041, pl. 46, fig. 24.

Tellina sagræ Guppy, 1910, Agri. Soc. Trinidad and Tobago, Springvale Fossils. See Harris' Reprint, 1921, Bull. Amer. Paleont., vol. 8, p. 302.

Metis trinitaria Maury, Sept., 1919, Amer. Jour. Sci., vol. 48, pp. 212, 214.

Metis trinitaria Cooke, Oct., 1919, Carnegie Inst. Washington, Publ. No. 291, p. 148, pl. 14, figs. 2a, 2b.

Metis trinitaria Maury, 1920, Sci. Surv. Porto Rico and the Virgin Islands, vol. 3, pt. 1, p. 42.

Metis trinitaria Hubbard, 1921, Sci. Surv. Porto Rico, vol. 3, pt. 2, p. 125, pl. 10, fig. 7.

Cf. *Metis postrema* Pilsbry and Johnson, 1918, Proc. Acad. Nat. Sci. Phila., vol. 69, p. 202; Pilsbry, *Idem*, 1922, vol. 73, p. 426, pl. 46, fig. 8.

Shell under favorable circumstances becoming very large, oval-oblong, anterior end rounded, produced, posterior end shorter, biscalate on the right valve; left valve with one posterior sulcation corresponding in position to the arch between the two furrows of the right; surface smooth except for fine, concentric lines of growth. Pallial sinus very large, rounded, somewhat larger and higher in

the left than in the right valve. A large shell measures in length 72, altitude 57, diameter 30 mm.; smaller specimens 40 x 33 x 14; 34 x 29 x 12. The type was 52 x 41 x 19, and *vide* Dr. Dall, the shell may attain twice this size.

This species is characterized by the marked anterior elongation and arcuate form.

In differentiating Porto Rican horizons by faunal groups I found *Metis trinitaria* to be one of the most abundant fossils of the Quebradillas limestone, northwestern Porto Rico. It also occurs, but rarely in the Los Puertos and Ponce limestones, which are on the southern side of the island. In Cuba it is reported from Santiago, La Cruz, and Vento; from Anguilla at Crocus Bay; from Barbuda; and very large shells, perhaps his species, are in the Columbia University collection from Sombrero Island.

Localities.—Springvale, Department of Caroni, very large specimens (the type was from the Caroni series); a smaller specimen, probably the same species, from the northwest corner of F 16 (in the southern part of Department of St. Andrew, west of Manzanilla Bay); Guaico-Tamana Road at $7\frac{3}{4}$ miles; Manzanilla.

Horizons.—Springvale Miocene; Manzanilla Miocene.

Genus *PETRICOLA* Lamarck

Petricola caroniana, n. sp.

Pl. 20, Fig. 16

Shell transversely elliptical, moderately convex, thin and fragile. Beaks low, approximate, situated at about the anterior third of the total length. Anterior and central areas gently convex, posterior area slightly compressed dorsally; posterior and anterior margins rounded. Basal margin nearly parallel to the hinge line. Entire surface closely and prettily sculptured with fine, radiating threads, their interspaces somewhat wider; on the posterior area the threads are rather closer than on the center of the disc, but they are of much the same strength all over the shell. Narrow, concentric ridges mark the surface at irregular inter-

vals, usually not interrupting the radial threads, but occasionally altering the trend of their direction. Length of larger shell 30, altitude 22, diameter 14; the smaller is 26 x 19 x 13 mm.

This species has the type of sculpture and somewhat the form, though proportionally shorter, of *Petricola* (*Petricolaria*) *calvertensis* Dall, from the Maryland Miocene. It is even more closely akin to *P. millestriata* Brown and Pilsbry, from the Gatun beds. The latter species, however, has higher, more prominent beaks, and the base is not parallel to the hinge but is obliquely produced posteriorly, so that the height of the posterior end of the shell is considerably greater than that of the anterior. More material may possibly show the Trinidad shell to be a variety of the Gatun. These three, *calvertensis*, *millestriata* and *caroniana*, seem to form a group—although the internal characters of the last two are unknown.

In the Dominican Miocene, *P. camitica* Maury, is characterized by its very varied V-shaped sculpture, while *P. riocanensis* Maury is akin to the living *Petricola* (*Rupel-laria*) *typica* Jonas (= *lithophaga* Arango; *robusta* Dall, not Sowerby). This appeared first in the Florida Pliocene and now ranges through the Antilles. It is radiately ridged, more coarsely so posteriorly. Another recent Antillean species is *Petricola lapicida* Gmelin (= *divergens* Gmelin; *costata* Lamarck; *divaricata* d'Orbigny), with ziczac markings on the young stages and coarse, posterior ridges on the adult. It is the type of *Petricola*, *sensu stricto*. The handsomest Antillean and Nicaraguan recent form is *P.* (*Petricolaria*) *pholadiformis* Lamarck, with strong, crenulated, anterior ribs and elsewhere radial striations. These recent species are mentioned as they may be found on the shores of Trinidad.

Locality.—Springvale.

Horizon.—Upper Miocene.

Genus *CARDIUM* (Linnæus) LamarckSubgenus *TRACHYCARDIUM* Morch*Cardium* (*Trachycardium*) *inconspicuum*, Guppy

Cardium inconspicuum Guppy, 1866, Quart. Jour. Geol. Soc. London, vol. 22, p. 293, pl. 18, fig. 12.

Cardium inconspicuum Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 163; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 42.

Cardium inconspicuum Guppy, 1874, Geol. Mag., London, p. 442.

Cardium (*Trachycardium*) *inconspicuum* Dall, 1900, Trans. Wagne: Inst. Sci., vol. 3, p. 1182.

Shell rather small, ovate, with thirty-six to forty-two ribs (the type had thirty-eight), all of which except those on the posterior area are finely imbricated with close, concentric threads. Posterior ribs smooth and polished. Interspaces narrower than the ribs, squamose. The type was about 20 mm. in length and 24 in height.

Localities.—Bowden, Jamaica; Chipola, Florida.

Horizons.—Middle and Lower Miocene.

Cardium (*Trachycardium*) *caroniense*, n. sp.

Pl. 22, Fig. 4

Shell rather small, ovate, thin, with a delicate hinge; moderately inflated. Ribs twenty-three. Of these, the three or four in front of the umbonal slope are rounded, but all the others are angulate, the ridge of the anterior ribs being directed backwards, and the ridge of each of the posterior ribs being directed forwards, so that both sets face towards the rounded central ribs. All the ribs appear entirely smooth. Length 21, height 26, semidiameter 11 mm.

This species is a member of the group of *C. dominicanum* Dall, from the Miocene of Santo Domingo, and *C. costaricanum* Olsson, from the Gatun stage of Costa Rica. *C. dominicanum* is solid, with a heavy hinge, and twenty-seven ribs, and our shell is much nearer to *C. costaricanum*. A comparison shows, however, that the Costa Rican shell is much produced at the termination of the umbonal slope, so that a radius from the beak to the posterior basal margin would be much longer than one to the anterior basal margin.

But the basal margin of the Trinidad shell is nearly evenly rounded and there would be but little difference in an anterior and a posterior basal radius. Moreover, although the ribs are about the same in number, the anterior and posterior ribs of the Trinidad shell are sharper-edged and overlap like the clapboards of a house and on the single specimen we have the ribs are smooth, while the anterior and some of the central ribs of Mr. Olsson's shell are finely beaded or granose on their ridges. But the most striking difference is in the form of the shells.

Locality.—Springvale.

Horizon.—Upper Miocene.

Cardium (Trachycardium) isocardia, Linnæus Pl. 22, Figs. 5, 7

Cardium isocardia Linnæus, 1758, Syst. Nat., ed. X, p. 679.

Cardium isocardia Chemnitz, 1782, Conch. Cab., vol. 6, p. 182, pl. 17, figs. 174–176.

Cardium isocardia Reeve, 1845, Conch. Icon., *Cardium*, pl. 17, fig. 84.

Cardium isocardia d'Orbigny, 1845, Hist. de la Isla de Cuba, vol. 5, *Moluscos*, p. 337.

Cardium egmontianum Shuttleworth, 1856, Journ. de Conchyliologie, vol. 5, p. 472.

Cardium isocardium Guppy, 1864, Trans. Sci. Assoc. Trinidad, pp. 36, 40; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, pp. 16, 20.

Cardium eburniferum Guppy, 1875, Ann. and Mag. Nat. Hist., 4th ser., vol. 15, p. 51, pl. 7, fig. 3.

Cardium (Trachycardium) isocardia Dall, 1900, Trans. Wagner Inst. Sci., vol. 3, p. 1085.

Cardium (Trachycardium) isocardia Maury, 1920, Bull. Amer. Paleont., No. 34, p. 62.

Linnæus included in *C. isocardia* the East Indian form, later separated by Gmelin as *C. squamosum*.

C. isocardia is the type of the subgenus *Trachycardium*. It is "the equiheart cockle"—obliquely cordate, typically with about thirty-four squarish ribs, bearing rather distant, obliquely-set, arched scales, often spinose posteriorly. Living shells vary in color, some are white maculated with pinkish straw, others with red-purple, or orange-brown. Large specimens may attain a height of 80 or 90 mm. Ours from Venezuela are small, the largest 49 in height, a smaller in length 37, height 42, semidiameter 16 mm. A feature of

the Trinidad and Venezuelan specimens is the greater number of ribs—thirty-five to thirty-nine against twenty-seven to thirty-four in shells from the more northern localities. This parallels the increased ribbing of *C. muricatum* as the shell approaches its more southern limits.

In Dr. Guppy's 1864 Matura list *C. isocardia* is given. but in 1874 he substituted *C. muricatum*. *C. eburniferum* Guppy is identical with *C. isocardia*.

The range of *C. isocardia* is from Hatteras to Trinidad, and west to Venezuela, also through Cuba, Nevis, St. Lucia and Martinique. It first appeared in the Miocene. The west coast analogue is *C. consors* Broderip and Sowerby, with closer, more numerous scales.

Localities.—Southern coast of Trinidad; La Guayra roadstead, Venezuela.

Horizon.—Recent.

Cardium (*Trachycardium*) *lingua-leonis*, Guppy Pl. 23, Fig. 17

Cardium lingua-leonis Guppy, 1866, Quart. Jour. Geol. Soc. London, vol. 22, p. 293, pl. 18, fig. 7.

Cardium lingua-leonis Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 163; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 42.

Cardium lingua-leonis Guppy, 1874, Geol. Mag., London, p. 442.

Cardium (*Trachycardium*) *lingua-leonis* Dall, 1900, Trans. Wagner Inst. Sci., vol. 3, p. 1084.

Cardium (*Trachycardium*) *lingua-leonis* Maury, 1917, Bull. Amer. Paleont., No. 29, p. 210.

Shell large, very high and narrow, hardly oblique, with thirty-two ribs. The ribs bear side keels which are waved and rippled on their crests in a manner aptly compared by Dr. Dall to confectioners' rippled candy, or like rippled decorations on cakes. A shell from the type locality collected by Mr. Olsson, in 1923, is 35 mm. in length, 50 in height and 20 in semidiameter.

This species is a very beautiful and striking member of the group of *Cardium isocardia* Linnæus. Gabb erroneously placed it in the synonymy of *C. subelongatum* Sowerby, 1840, from which it is quite distinct.

A related Dominican Miocene species is *C. linguatigris*

Maury, with forty-two ribs, flatter and smoother.

Locality.—Bowden, Jamaica.

Horizon.—Middle Miocene.

Cardium (*Trachycardium*) *muricatum* Linnaeus

Pl. 22, Fig. 9

Cardium muricatum Linnæus, 1758, Syst. Nat., ed. X, p. 680, No. 69.

Cardium campechiense Bolten, 1798, Mus. Boltenianum, p. 191, No. 497.

Cardium muricatum d'Orbigny, 1843, Voyage dans l'Amér. Mérid., vol. 3, *Mollusques*, p. 591.

Cardium muricatum Reeve, 1844, Conch. Icon., *Cardium*, pl. 6, fig. 33.

Cardium muricatum d'Orbigny, 1845, Hist. Pol. y Nat. Isla de Cuba, vol. 5, *Moluscos*, p. 335.

Cardium gosseii Deshayes, 1854, Proc. Zool. Soc., p. 330.

Cardium muricatum Guppy, *pro parte*, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 163; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 42; 1874, Geol. Mag., p. 442.

Cardium aquilaterale Hilgard, 1878.

Cardium (*Trachycardium*) *muricatum* Dall, 1900, Trans. Wagner Inst. Sci., vol. 3, p. 1089; 1900, Proc. U. S. Nat. Mus., vol. 23, p. 385.

Cardium (*Trachycardium*) *muricatum* Maury, 1920, Bull. Amer. Paleont., No. 34, p. 62.

Shell of moderate size, obliquely ovate, with thirty to forty-one ribs, the anterior twelve or fourteen bearing pedunculated nodules, and the central and posterior ribs with easily abraded, minute tooth-like spines, posterior ribs frequently split. The Trinidad shells have more ribs (36-41) than our Gulf coast Pleistocene and recent specimens (32-33), which tallies with Dr. Dall's statement that individuals from the northern part of the range, and fossil forms, have sparser ribbing than those from the southern part of the range. Color usually white maculated with brown and orange, but one of ours is very handsome, white, with pale ecru and straw, banded with salmon pink; another is white with rose-purple. A shell from Erin Point is in length 44, height 51, semidiameter 17 mm., but the species may attain 54 x 60 mm.

The range is from Hatteras to Brazil and the Gulf of Mexico—type locality, Gulf of Campeche. Pleistocene to Recent.

Localities.—Southwest of San Fernando between Ally

and Mosquito Creek; Erin Point. on the south coast; Mayaro Point, Trinidad; also Venezuelan coast.

Horizon.—Recent.

Cardium (*Trachycardium*) *couvense*, n. sp.

Pl. 23, Fig. 12

Shell rather small, plump, subequilateral, suborbicular, with full, low beaks nearly central in position. Ribs varying in number from thirty-five to forty, narrow, with linear interspaces. The posterior ribs are more or less cleft and all the ribs show definite traces of murication. Length of shell 23, altitude 21, semidiameter 6 mm.

This delicate shell is evidently an ancestral member of the *C. muricatum* group.

Locality.—Springvale, near Couva.

Horizon.—Upper Miocene.

Cardium (*Trachycardium*) *bowdenense*, Dall

Cardium muricatum Guppy, *pro parte*. Not of Linnæus, 1758.

Cardium (*Trachycardium*) *bowdenense* Dall, 1900, Trans. Wagner Inst. Sci., vol. 3, p. 1087.

There is confusion regarding this species. Dr. Dall places in his synonymy *C. muricatum* Guppy, 1874, Geol. Mag., p. 450, and then says: "This species from the Bowden marl and from the Tampa silex beds at Ballast Point, Tampa Bay, Florida, was identified with the recent *muricatum* by Guppy." But on p. 442 (not 450) of the Geological Magazine, *C. muricatum* is listed by Guppy from the Matura Pliocene, not from Bowden; nor can I find any reference to *C. muricatum* from Bowden by Guppy. But the specimen might have been in his collection, later purchased by the United States National Museum.

Cardium bowdenense has thirty-seven to forty-one ribs, the sculpture being like that of *muricatum* in miniature. The shell is less inflated, and always small—the largest being 15.5 x 15.5 x 9 in diameter. It has apparently never been figured.

Localities. — Tampa, Florida, silex beds; Bowden,

Jamaica.

Horizons.—Upper Oligocene and Middle Miocene.

Cardium (Trachycardium) sancti-davidis, n. sp.

Pl. 22, Fig. 3

Shell of moderate size, subcircular in outline, thin and delicate, plump, nearly equilateral, with low beaks. Ribs usually forty-three, but varying from forty-one to forty-four. The anterior seventeen to twenty-four bear minute pedunculated nodules, after which the ribs have minute denticles, these being on the posterior edge of the ribs in front of the carination, and on the anterior edge of those behind it. The ten posterior ribs are more or less grooved. Length of largest specimen 30, height 31, semidiameter 11 mm. The majority are about 26 x 27 mm.

This dainty shell is a chain in the ancestral line of the Pleistocene to Recent *C. muricatum* Linnaeus. It is smaller, about half the size of *muricatum*, but twice as large as the Oligocene-Miocene *C. bowdenense* Dall. The general plan of sculpture is like that of *muricatum*, but the ribs are more numerous and the pedunculated nodules extend over a wider area. The form of the shell is more circular and less oval than our Trinidad specimens of *muricatum*.

C. bowdenense is described by Dr. Dall as less inflated than *muricatum*, but the Matura shell is fully as plump as *muricatum* if not more so. The Florida Pliocene *C. ædalium* Dall of the *muricatum* line has fewer ribs and is much more coarsely and differently sculptured.

Locality.—Matura.

Horizon.—Upper Pliocene.

Cardium (Trachycardium) tamanense, n. sp.

Pl. 22, Fig. 6

From Miocene beds in central Trinidad we have many specimens of a *Cardium* apparently the same species although much deformed by pressure. The normal form seems to have been ovate to subcircular and although all the specimens are merely casts, a few show traces of imbricating scales on the ribs. The shell is referred only tenta-

tively to *Trachycardium*.

This species can, however, be recognized among other Trinidad species of *Cardium* by the equal, even, closely-set and very numerous ribs, of which there are about forty-eight to fifty.

In the crowded ribbing the shell recalls the Dominican Miocene *C. dominicense* Gabb, with sixty ribs. But no comparison is possible because of the crushed form and absence of surface sculpture of the Trinidad specimens. A cast of ovate form measures in length 35, height 40, semidiameter 12 mm. This and the rounded casts may not be the same species, but the distortion of the specimens forbids any discrimination beyond the fact that a many-ribbed *Cardium* is abundant in the Tamana Miocene.

Locality.—Central E 24, No. 393; East Central E 25, No. 381.

Horizon.—Tamana Miocene.

***Cardium (Trachycardium) venadense*, n. sp.** Pl. 23, Figs. 11, 16

Shell of medium size, ovate, nearly equilateral, not much inflated. Beaks low, small, inconspicuous. The entire surface is very finely, neatly, evenly and closely sculptured with a great number of narrow ribs of which there are about sixty. The ribs over the anterior half are distinctly shown by the best preserved shell, which is incomplete, to have been muricated and some appear also to have been nodose. In the other specimen all the ribs are more smooth. Hinge normal, delicate. Inner margin of shell very finely serrate. Largest specimen 34 mm. altitude, 30 length, 9 semidiameter. A smaller is 28 x 26 and 18 in diameter.

In the great number of ribs this recalls *C. dominicense* Gabb, but is much more narrowly ovate, and the ribs are all very even, while in the Dominican shell they become much coarser posteriorly and the inner margin is coarsely serrate. The Trinidad shell is much more delicate, regular and evenly sculptured.

Locality.—Brasso Venada Ravine, three miles east of

Brasso Station.

Horizon.—Manzanilla Miocene.

Cardium serratense, n. sp.

Pl. 23, Fig. 15

Shell fairly large, very high and protracted, subequi-lateral. Anterior area somewhat compressed, anterior basal margin rounded, central area very convex; umbonal slope rounded, not carinate; posterior area flattened. Beaks high, narrow, curving. Ribs about twenty, the anterior and posterior more crowded than those over the center of the shell which are strong and prominent. The specimens are all in the form of casts and the finer details of the sculpture are not known. Length 30, height 45, semidiameter 13 mm.

This species is entirely different in form from any of the other Trinidad *Cardiums*, and can be readily known by its very narrow, protracted aspect and coarse ribbing.

Locality.—Half a mile above Brasso Station in the quarry at the junction of the roads.

Horizon.—Brasso Miocene, uppermost member of the section.

Cardium (Trachycardium) machapooriensis, n. sp. Pl. 23, Figs. 13, 18

Shell ovate, narrow, and high, inflated, nearly equi-lateral. Beak very high and very strongly curved forwards. Entire surface sculptured with exceedingly fine, close-set, subequal, radial ribs numbering about forty-six. Every rib bears on its crest a row of minute, cone-shaped, hollow scales. Interspaces linear. Our largest specimen measures in length 21, altitude 32, semidiameter 14 mm.

Locality.—Machapoorie quarry.

Horizon.—Machapoorie Miocene.

Subgenus *FRAGUM* Bolten

Cardium (Fragum) medium Linnæus

Pl. 23, Fig. 19

Cardium medium Linnæus, 1758, Syst. Nat., ed. X, p. 678.

Cardium medium Reeve, 1844, Conch. Icon., *Cardium*, pl. 6, fig. 30.

- Cardium medium* d'Orbigny, 1845, Hist. Pol. y Nat. Isla de Cuba, vol. 5, Moluscos, p. 336.
Cardium (Fragum) medium Dall, 1900, Trans. Wagner Inst. Sci., vol. 3, p. 1101.
Cardium (Fragum) medium Maury, 1920, Bull. Amer. Paleont., No. 34, p. 64.
Cardium (Fragum) medium Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 226, pl. 27, fig. 6.

Shell of moderate size, cordately subquadrate, anterior rounded, umbonal slope strongly carinate, posterior area sulcate, concave, and truncate. Ribs thirty-six, subequal, smooth and polished when abraded; but when living and perfect the ribs are exceedingly closely-set with beautifully imbricating scales, their edges giving an annular aspect under a lens, or like piles of coins pushed obliquely. Large shells measure 44x43 mm.—ours are small, only 29x30x24.

This species ranges from North Carolina to Santa Marta, Brazil, and is abundant in the West Indies. It appears first in the Miocene of Maryland, is in the Gatun stage of Port Limon, Costa Rica, and the Pliocene of Florida.

Locality.—Grenada Island, West Indies.

Section *TRIGONIOCARDIA* Dall

This section is characteristic of the Eastern and Western Middle American and the Antillean regions. Dr. Dall traces its origin as an off-shoot of *Fragum*, beginning in the Eocene. An interesting light is thrown on this relationship by our Pliocene *C. (Trigoniocardia) perii-maris*, which in form is strikingly like young shells of *Fragum medium*, but differs in having fewer ribs and in the cross striate interspaces, characteristic of *Trigoniocardia*.

- Cardium (Trigoniocardia) castum* Guppy Pl. 23, Figs. 2, 3, 7
Cardium castum Guppy, 1866, Quart. Jour. Geol. Soc., London, vol. 22, p. 582, pl. 26, fig. 4.
Cardium castum Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 163; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 42.
Cardium castum Guppy, 1874, Geol. Mag., London, p. 442.

Our specimens from Manzanilla, the type locality, answer well to Dr. Guppy's description of this species. The shell is very small, somewhat oblique, squarish posteriorly, and with a rather prominent beak. Typically the umbonal slope is roundly carinate, but in some specimens it is quite sharply so. The ribs are as many as nineteen to twenty-two (as in the type), thirteen or fourteen ribs being on the body, and seven or eight on the truncation. When perfectly preserved, the ribs on the body and on the truncation bear minute pustules, very easily abraded and rarely seen. Interspaces with the strongly marked cross striations characteristic of the section *Trigoniocardia*. Large valves are 7 mm. in length, by 6 altitude, and 3 semidiameter; 6.5 x 7 x 3; 6 x 6 x 2.5 mm. The young shells are 4 mm. or less in length.

Localities.—Manzanilla Bay, Nos. 272, 273, 385; Brasso section near bridge at Tamana Road Junction.

Horizon.—Manzanilla Miocene.

Cardium (*Trigoniocardia*) *castum* var. *brassicum*, n. var. Pl. 23, Fig. 6

Shell differing from *C. castum* in is much higher, elongate-oval form, sharply carinated umbonal slope, and produced posterior basal margin. Umbones high, acute. Ribs nineteen or twenty, about eleven on the body and eight on the truncation, all closely and prettily beaded. Length 7, greatest height 10, semidiameter 4 mm. A large valve measures 8 in length by 12 in height.

Localities.— $\frac{1}{2}$ mile above Brasso; near bridge at Tamana Road Junction.

Horizons.—Brasso Miocene; Manzanilla Miocene.

Cardium (*Trigoniocardia*) *manzanillense*, n. sp. Pl. 23, Fig. 4

Shell minute, very sharply carinate on the umbonal slope, with nineteen or twenty ribs, about eight on the truncation and eleven on the body. Those on the truncation are low and flat. The two or three ribs on the body in front of the carination are very bold, large, and with a

sharp medial ridge, minutely beaded when perfect. The interspaces between these large ribs are wide and deep. The anterior ribs are somewhat more coarsely beaded. Length of largest valve 5 mm., altitude 5.5.

This shell is distinguished from *C. castum* by the different character of the ribbing—the two or three larger ribs in front of the carina standing out very prominently, which is not the case in *C. castum*. In the boldness of the central ribs *C. manzanillense* resembles the recent *C. antillarum* d'Orbigny; but the fossil shell is easily differentiated by its higher, much more sharply carinated form.

This pretty and striking species was found at only one collecting station.

Locality.—Manzanilla.

Horizon.—Manzanilla Miocene.

Cardium (Trigoniocardia) antillarum d'Orbigny Pl. 23, Fig. 5

Cardium antillarum d'Orbigny, 1845, In de la Sagra's Hist. Pol. y Nat. Isla de Cuba, vol. 5, *Moluscos*, p. 338, Atlas, pl. 27, figs. 53-55.

Cardium ceramidum Dall, 1886, Blake Rept. 1, p. 269, pl. 4, fig. 6.

Cardium antillarum Dall, 1889, Bull. U. S. Nat. Mus., No. 37, p. 52, pl. 4, fig. 6.

Cardium (Trigoniocardia) antillarum Dall, 1900, Proc. U. S. Nat. Mus., vol. 23, p. 386.

Shell minute, with twenty or twenty-one radial ribs, those on the anterior part of the valve being prettily and finely beaded, the three or four central ribs are much larger and bolder, the posterior, narrower and closer. Interspaces with the transverse striæ of *Trigoniocardia*. The type measured a trifle over 7 mm.; Dr. Dall's, 12.5; our largest is about 4 mm.

D'Orbigny says that the central ribs are smooth, and in some of ours they are; but in others, they are beaded. Either the beading is variable, or the nodules are abraded. I rather think that when perfect all the ribs are more or less beaded.

This very attractive little shell ranges from Florida Strait through the West Indies, in 2-182 fathoms. Its

southern limit was given by Dr. Dall as Guadeloupe; but we can now extend its range to Trinidad.

Locality.—Gulf of Paria, $\frac{1}{4}$ mile west of Farallon Rock, off San Fernando.

Horizon.—Recent.

Cardium (Trigoniocardia) maturense Dall Pl. 23, Figs. 1, 9

Cardium haitense Guppy, *pro parte*, 1865, Geol. Mag., p. 256; 1874, Geol. Mag., p. 450.

Not *Cardium haitense* Sowerby, 1849, Quart. Jour. Geol. Soc., vol. 5, p. 52, pl. 10, fig. 11.

Cardium (Trigoniocardia) maturense Dall, 1900, Trans. Wagner Inst. Sci., vol. 3, p. 1105, pl. 48, fig. 7.

Shell rather small, obovate with a rounded umbonal slope. Ribs twenty to twenty-two, of which eight or nine are on the truncation and twelve or thirteen on the body. Ribs when perfect with very small bead-like nodules. Interspaces strongly cross striated. Length of type 6.6, altitude 9, diameter 7 mm.

From the type locality we have several valves of this species, but larger, measuring 7 x 9 and 9 x 12 mm.

Locality.—Matura.

Horizon.—Upper Pliocene.

Cardium (Trigoniocardia) mirandense, n. sp. Pl. 23, Fig. 10

Shell small, triangulate, very sharply carinate, posterior basal margin pointed, beak high, acute. Sculpture of twenty-two ribs of which eight are on the truncation and fourteen on the body. All the ribs are conspicuously and evenly beaded. Interspaces cross barred, as in *Trigoniocardia*, but very clearly and neatly so. Length 11.5, greatest height 12, semidiameter 5 mm.

A very handsome species noticeable for its exact form and precise and elegant beading.

Locality.—State of Zulia, District of Miranda, north-western Venezuela.

Horizon.—Lower Miocene, about equivalent to the Cercado formation of the Dominican Republic.

Cardium (Trigoniocardia) perii-maris, n. sp.

Pl. 23, Fig. 8

Shell rather small, cordately subquadrate, rounded anteriorly, pointed behind, obliquely truncate posteriorly, beaks rather high, umbonal slope very markedly carinate, and in front of the carination is a deep sulcation from beak to base, which renders the basal margin deeply arcuate. There is also a lesser sulcation behind the carina, on the posterior area, which slightly emarginates the posterior margin. The sculpture is of twenty-four ribs, of which fifteen are on the body and nine on the truncation. The ribs on the body are very low, flat, and wide, those on the truncation are narrower and closer. All the ribs appear to be entirely smooth. Interspaces very narrow, almost linear, crossed by minute, equidistant, transverse bars, the spaces between giving a punctate appearance to the interspaces. Inner margins of shell fluted. Hinge delicate, but teeth rather strong. Length 12, height 11.5, semidiameter 5 mm.

This species is at once distinguished from our other Trinidad *Trigoniocardias* by the wide ribs, without nodules, and the very narrow, punctate interspaces. In sculpture, the shell is very like Dr. Dall's *C. apateticum* from the Oak Grove, Florida, Miocene. That, however, has fewer ribs and differs in form, being evenly inflated with no suggestion of the two striking sulci in the Trinidad shell.

C. heredium Olsson, from the Gatun of Costa Rica, has wider interspaces without the punctate character of those of the Trinidad and Florida shells.

Locality.—Matura.

Horizon.—Upper Pliocene.

Cardium (Trigoniocardia) carolinæ Maury

Cardium (Trigoniocardia) carolinæ Maury, 1912, Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 15, p. 54, pl. 9, figs. 5, 6.

Shell small, triangularly convex, rounded anteriorly, truncated posteriorly, umbonal slope carinate; ribs on the

body nine, rather sharp-edged, ornamented with bead-like nodules, which on the four ribs towards the carina are on the posterior side of each rib, on the remaining five ribs are nearly central; ribs on the truncated area eight, more crowded, less elevated, squamose rather than beaded, interspaces on the body much narrower than the ribs, except the space beside the carinal rib, which is wider than the others, and is beautifully marked by cross striæ which also cross the other interspaces, but there are hardly seen except with a lens. Height 11, length 7, diameter 8 mm.

An exquisite shell, allied to *castum* Guppy, from Manzanilla, but that has twenty-two rounded ribs and the posterior slope is different.

Locality.—Brighton, a thousand feet west of the pier, in impure asphalt.

Horizon.—Upper Pliocene.

Subgenus *PAPYRIDEA* Swainson

Cardium (*Papyridea*) *spinosum* Meuschen

Cardia spinosa Meuschen, 1787, Mus. Gevers., p. 442, No. 1637 (after Lister, pl. 342, fig. 179, Jamaica, and Knorr, 6, pl. 7, fig. 6).

Solen bullatus Chemnitz, 1782, Conch. Cab., vol. 6, p. 65, pl. 6, figs. 49, 50.

Not *Solen bullatus* Linnæus, 1758, Syst. Nat., ed. X, p. 673. (= *Arca*, sp.)

Cardium bullatum Reeve, 1844, Conch. Icon., *Cardium*, pl. 2, fig. 8.

Cardium bullatum d'Orbigny, 1845, Hist. Pol. y Nat. Isla de Cuba, vol. 5, *Moluscos*, p. 337.

Cardium (*Papyridea*) *bullatum* Dall, 1889, Bull. U. S. Nat. Mus., No. 37, p. 54.

Cardium (*Papyridea*) *spinosum* Dall, 1900, Trans. Wagner Inst. Sci., vol. 3, p. 1106; 1900, Proc. U. S. Nat. Mus., vol. 23, p. 387.

Cardium (*Papyridea*) *spinosum* Maury, 1920, Bull. Amer. Paleont., No. 34, p. 64.

Shell transversely ovate, thin, gaping; with about forty-seven rather narrow ribs, the anterior crenulated, the posterior squamose. Interspaces with a fine radial thread. White variegated with rose or purple. Length 53, height 34 mm.

This very beautiful shell is apparently not recorded from Trinidad; but likely to be found there, as its range

extends south to Santa Marta, Brazil.

Localities.—West Indies generally, as Nevis, St. Vincent, Jamaica, Cuba, Martinique, St. Lucia and Guadeloupe.

Horizons.—Pleistocene (Florida and Antilles) ; Recent.

***Cardium (Papyridea) semisulcatum* Gray**

Cardium semisulcatum Gray, 1825, Ann. Phil., vol. 9, p. 137.

Cardium ringiculum Sowerby, 1840, Proc. Zool. Soc., p. 106; 1841, Conch. Illust., *Cardium*, p. 2, pl. 48, fig. 11.

Cardium Petitianum d'Orbigny, 1845, Hist. Pol. y Nat. Isla de Cuba, vol. 5, *Moluscos*, p. 337, Atlas, pl. 27, figs. 50-52.

Cardium semisulcatum E. A. Smith, 1885, Challenger Rept., Biv., p. 162.

Papyridea Petitiana Dall, 1889, Bull. U. S. Nat. Mus., No. 37, p. 54.

Cardium (Papyridea) semisulcatum Dall, 1900, Trans. Wagner Inst. Sci., vol. 3, p. 1108.

Cardium (Papyridea) semisulcatum Dall, 1900, Proc. U. S. Nat. Mus., vol. 23, p. 387.

This exquisite little species is elongate, compressed; anterior end rounded, posterior truncated; gaping, with twenty-six ribs, the posterior very much coarser than the anterior. Color varying from white to red, yellow, rose and red-purple. D'Orbigny's *Petitianum* measured 18 mm.

The range is from southern Florida to Cape San Roque, Brazil; also off Liberia and the Cape of Good Hope. It first appeared in the Miocene of North Carolina.

Locality.—Trinidad (Dall).

Horizon.—Recent.

Subgenus *LÆVICARDIUM* Swainson

***Cardium (Lævicardium) serratum* Linnæus**

Pl. 23, Fig. 14

Cardium serratum Linnæus, 1758, Systema. Naturæ, ed. X, p. 680; 1767, ed. XII, p. 1123.

Cardium lævigatum Lamarek, 1819, Anim. sans Vert. VI, pt. 1, p. 11. Not of Linnæus, 1758, Syst. Nat. X, p. 680; nor of Born, 1780, Mus. Vind. Test., p. 47.

Cardium (Lævicardium) serratum Dall, 1900 (in part), Trans. Wagner Inst. Sci., vol. 3, pt. 5, p. 1110; 1903, pt. 6, p. 1587.

Cardium (Lævicardium) serratum Brown and Pillsbry, 1911, Proc. Acad. Nat. Sci. Phila., p. 367.

Cardium (Lævicardium) serratum Maury, 1917, Bull. Amer. Paleont., No. 29, p. 212, pl. 36, fig. 8; *Idem*, No. 30, pp. 10, 22, 23, 24.

Cardium (Lævicardium) serratum Vaughan, 1919, Bull. U. S. Nat.

Mus., No. 103, p. 562.

Cardium (*Lævicardium*) *serratum* Maury, 1920, Sci. Surv. Porto Rico and the Virgin Islands, vol. 3, pt. 1, pp. 36, 37; 1920, Bull. Amer. Paleont., No. 34, p. 65.

Cardium (*Lævicardium*) *serratum* Hubbard, 1921 (in part), Sci. Surv. Porto Rico, vol. 3, pt. 2, p. 114.

Cardium (*Lævicardium*) *serratum* Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 228, pl. 27, figs. 11, 12.

This well-known species ranges from Miocene to Recent, its present distribution being from Hatteras to Brazil and in the Gulf of Mexico from Florida to Texas.

In the Miocene it is found in the Dominican Republic, Porto Rico, Jamaica, the Gatun stage of the Canal Zone, and Costa Rica. It is often erroneously regarded as identical with *Lævicardium venustum* Gabb; but, as I noted, in 1917, *venustum* is a distinct species, with much fuller beaks, turned strongly forward, and the form of the shell is more ovate and less triangulate than in *serratum*.

Our many specimens indicate that *serratum* was common on the Miocene beaches of Trinidad.

Locality.—Springvale.

Horizon.—Upper Miocene.

Genus *DOSINIA* Scopoli

Section *DOSINIDIA* Dall

Dosinia (*Dosinidia*) *titan*, n. sp. Pl. 24, Figs. 1, 2; Pl. 25, Fig. 3

Dosinia liogona Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, p. 12; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 154.

Not *Dosinia liogona* Dall. 1903, Trans. Wagner Inst. Sci., vol. 3, pt. 6, p. 1230, pl. 53, figs. 4, 7, pl. 54, fig. 11.

Shell remarkably large, suborbicular, very convex for the genus, with small, acute beaks curving towards the impressed, cordate lunule. Surface sculptured with narrow, concentric groovings alternating with much wider strap-like bands about two millimetres in width. Towards the base of the disc the sculpture tends to become obsolete. Ligament sunken. Hinge plate not very wide. In the right

valve the posterior cardinal tooth is deeply sulcated and cleft into two nearly equal narrow ridges, the median and anterior cardinals are approximate and nearly equal, the median being only slightly larger and broader; together they form a notch for the interlocking of the left valve; beneath and anterior to this is a small pit for the left anterior lateral. Length of the largest complete shell 105, height 99, diameter 48 mm. Others are 103 x 93; 90 x 88 x 42; 83 x 82 x 34 mm.

This species closest fossil ally is *Dosinia grandis* Nelson, from the Miocene, Zorritos formation, of Peru; but the posterior dorsal margin of the Trinidad shell is higher and less sloping, and the ventral margin less produced than in the Peruvian species. In *grandis* the height is equal to or greater than the length of the shell, Nelson's types measuring 46 x 47 x 22 and 95 x 95 x 47; and Spieker's recent figure clearly indicates the relatively greater height (Paleont. Zorritos Form, John Hopkins Studies in Geol., No. 3, p. 138, pl. 8, fig. 4, 1922) measuring 93 x 96 mm. But in the Trinidad shell the length exceeds the height, so that the two species present a different form. Nelson (Trans. Conn. Acad., vol. 2, p. 201, 1870) described the right median cardinal tooth of *grandis* as *large and pointed* which suggests that these two great *Dosinias* also are somewhat unlike in the hinge characters.

The nearest living relative of *Dosinia titan* is also Pacific. It is *D. ponderosa* Gray (*gigantea* Sowerby), ranging from Lower California to Paita, Peru, and found in the Pleistocene of San Diego, Calif. As in the Trinidad species, the length of *ponderosa* is greater than the height; but the shell is smoother, the concentric sculpture being nearly obsolete on the center of the valve where fine, radial striæ are developed.

A very young shell in the Trinidad collection bears some likeness to *Dosinia liogona* Dall, from the Oak Grove Miocene of Florida. Probably Dr. Guppy had only a similar shell, and no adults, and hence was led to refer the Trinidad

species to *liogona*.

This great *Dosinia* exceeds in size all fossil species; but is eclipsed by a giant recent shell of *ponderosa* from Lower California, measuring 128 x 126 x 61 mm.

Locality.—Springvale.

Horizon.—Upper Miocene.

Dosinia (*Dosinidea*) *concentrica* Born

Pl. 25, Fig. 2

Venus concentrica Born, 1780, Mus. Vindob, p. 71, pl. 5, fig. 5.

Dosinia (*Dosinidia*) *concentrica* Dall, 1903, Trans. Wagner Inst. Sci., vol. 3, pt. 6, p. 1232.

This modern representative of *Dosinia*, which is found in the Pleistocene of Cuba, and living from the Florida Keys to Rio de Janeiro, seems very insignificant in comparison with the titanic, Upper Miocene *Dosinia* from Springvale.

Our Trinidad shell measures in length 34, altitude 34, semidiameter 11 mm.

Locality.—Gulf of Paria, off Farallon Rock, Trinidad.

Horizon.—Recent.

Genus *CLEMENTIA* Gray

Clementia dariena Conrad

Pl. 26, Figs. 1, 3, 5, 6, 7

Meretrix dariena Conrad, 1856, Pacific R. R. Reports, vol. 5, p. 328, pl. 6, fig. 55.

Clementia dariena Dall, 1903, Trans. Wagner Inst. Sci., vol. 3, pt. 6, p. 1235.

Clementia dariena Toulou, 1908, Jahrb. der K-K. Geol. Reichsanstalt, vol. 58, p. 725, pl. 27, figs. 9, 10.

Not *Clementia dariena* Hubbard, 1921, Sci. Surv. Porto Rico and the Virgin Islands, vol. 3, pt. 2, p. 118, pl. 19, figs. 10, 11 (which is *C. rabelli* Maury).

Clementia dariena Olsson 1922, Bull. Amer. Paleont., No. 39, p. 232, pl. 31, fig. 4 (Isthmian shells, but not the Porto Rico reference)

Because of the delicate texture of these shells, the individuals of *Clementia* are very plastic, and tend to assume an oblique form, and are easily subject to deformation. All degrees of obliquity and distortion can be found among our northern South American and Isthmian specimens of *C. dariena* as well as among the large quantity of specimens

of *C. rabelli*, collected by Dr. Reeds in Porto Rico, and now in the American Museum.

In forming concepts of species in this genus, it seems to me that, instead of measuring degrees of obliquity and deformation, as Mr. Hubbard has done, we must study the normal.

The normal form of *Clementia dariena* is that of a large clam-shaped shell, as shown by the figure herein given of an Isthmian specimen. This, like Conrad's figure of the type, and Olsson's figure 4 of a typical shell, shows a considerable projection of the shell in front of the beak. This specimen measures in length 60, altitude 55, diameter 32 mm.

The true form of the Porto Rican *Clementia rabelli* Maury (Sci. Surv. Porto Rico, vol. 3, pt. 1, p. 37, pl. 6, figs. 2, 3, 1920) is shown by the type, which was chosen from a great number of distorted specimens, as revealing the normal form. See Plate 26, Figure 1.

This species, which is very characteristic of the Collazo shales of Porto Rico, differs from *C. dariena* in being very short anteriorly. The shell, as shown by my type and by Mr. Hubbard's fig. 10, projects very little in front of the beak. It has almost exactly the form of the living *Clementia papyracea* of the Philippines. It also does not attain as large a size as *dariena*, the type measuring in length 43, altitude 36, diameter 25 mm.

Mr. Olsson in his synonymy (Bull. 39, p. 232, 1922) united *rabelli* with *dariena*; but later said he thought the Porto Rican shell was, after all, a distinct species.

In the Trinidad collection, we have two small specimens of *Clementia*, probably young shells of *C. dariena*. One measures in length 36, altitude 33, diameter 20; the other is 33 x 34 x 17 mm.

Localities.—Guaico-Tamana Road, at 7¾ mile post; also two specimens from Manzanilla, retaining the shell substance.

Horizon.—Manzanilla Miocene.

Clementia (?) *tæniosa* Guppy

Arcopagia tæniosa Guppy, M S

Clementia ? tæniosa Guppy and Dall, 1896, Proc. U. S. Nat. Mus., vol. 19, No. 1110, p. 327, pl. 30, fig. 8.

Clementia tæniosa Dall, 1903, Trans. Wagner Inst. Sci., vol. 3, pt. 6, p. 1235.

Clementia tæniosa Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 454, vol. 11, p. 9; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 165.

Clementia tæniosa Maury, 1920, Sci. Surv. Porto Rico and the Virgin Islands, vol. 3, pt. 1, p. 37.

Described by Dr. Guppy as "subtriangularly suborbicular, scarcely ventricose, concentrically ribbed, the ribs rounded with concave sulci between them. Alt. 43, lon. 47 mm." The type was an internal cast with imperfect hinge, but Dr. Dall thought there was little doubt that it was a species of *Clementia*. The nearly central beak with anterior and posterior margins sloping about equally to the rounded base, are differentiating characters of this species.

We have in our collections nothing corresponding to this description of *Clementia tæniosa*; and a search was vainly made for Dr. Guppy's type in the National Museum, in 1924.

Locality.—Savanetta, west central Trinidad (Guppy).

Horizon.—Upper Miocene.

Genus *TIVELA* Link

Tivela mactroides Born

Pl. 26, Fig. 8; Pl. 27, Fig. 3

Venus mactroides Born, 1778, Test. Mus. Cæes. Vind.

Venus corbicula Gmelin, 1782, *Tivela vulgaris* Link, 1807, *Venus turgens* (Solander MS), Dillwyn, 1817, *Cytherea corbicula* Lamarck, 1818.

Cytherea mactroides Reeve, 1863, Conch. Icon., *Cytherea*, pl. 5, figs. 18a, b, c.

Tivela mactroides Dall, 1902, Proc. U. S. Nat. Mus., vol. 26, p. 367.

Shell when well grown quite large and solid, trigonal, rather compressed anteriorly and posteriorly, ventricose; beaks high and swollen; pallial sinus, broad and round;

color whitish stained with pinkish purple or reddish chestnut, sometimes partly covered with a thin horny epidermis. A shell from St. Thomas, W. I., measures in length 45, altitude 40, diameter 28 mm.

Distributed through the Bahamas, Antilles and adjacent continental shores to Santa Catarina, Brazil. It is the type of the section *Tivela*, *sensu stricto*.

Young shells of *T. mactroides* were collected by Professor Harris on Trinidad.

Locality.—Erin Point on the southwestern coast.

Horizon.—Recent.

Tivela austeniana Maury

Pl. 27, Fig. 2

Mactra austeniana Maury, 1912, Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 15, p. 61, pl. 9, figs. 22, 23.

Shell small, thin, oblong-trigonal, posterior end somewhat produced and bluntly pointed; lunule very inconspicuous, ill-defined; teeth as shown in the figure, hinge plate narrow, pallial sinus rather short, broad and rounded. Length of type 27, altitude 21, semidiameter 7 mm.

A young shell of *T. mactroides* Born (measuring, length 25, alt. 24, sd. 8 mm.) of approximately the same size as *T. austeniana* is much higher, much shorter posteriorly, more inflated and has fuller beaks, so that the outline of the two shells is very different.

Tivela nasuta Dall (Proc. U. S. Nat. Mus., vol. 26, p. 380, pl. 12, fig. 2, 1902) approaches more nearly in form to *T. austeniana*, but has the lunule impressed, and defined by a distinct incised line, while in *austeniana* the lunule is not impressed, and is very faintly bordered by a raised thread. Moreover, in *nasuta* the surface is rudely striated, but in *austeniana* where not worn it is very smooth.

Locality.—Along the shore, 1000 feet west of the Brighton pier, in an impure asphalt.

Horizon.—Upper Pliocene.

Tivela austeniana var. *maturensis*, n. sp.

Pl. 27, Fig. 1

We have a number of Tivelas from the Matura beds which are intermediate in form between the Pliocene *austeniana* and young shells of the Recent *mactroides*.

They are about the size of *austeniana* and resemble it in the form of the umbo and degree of convexity, but the posterior end is shorter, as in young *mactroides* which the base of the shell approaches in form. The hinge is heavy for the size of the shell, much more so than in *austeniana*. The largest specimen measures in length 25, altitude 24, semidiameter 7 mm.

Locality.—Matura, northeastern Trinidad.

Horizon.—Upper Pliocene.

Genus *MACROCALLISTA* Meek

Section *CHIONELLA* Cossmann

***Macrocallista (Chionella) maculata* Linnæus** Pl. 25, Figs. 1, 4, 5

Venus maculata Linnæus, 1758, Syst. Nat., ed. X, p. 686.

Cytherea maculata Lamarck, 1818, Anim. sans Vert., vol. 5, p. 566.

Cytherea maculata Sowerby, 1842, Conch. Man., fig. 117d; 1851, Thes. Conch., 7, 629, pl. 131, fig. 97.

Callista maculata Moersch, 1853, Cat. Yoldi, vol. 2, p. 28.

Cytherea dariena Conrad, 1857, Pacific R. R. Rept., vol. 6, p. 72, pl. 5, fig. 21.

Dione maculata Reeve, 1863, Conch. Icon., *Dione*, pl. 3, figs. 11a, 11b.

Callista maculata Gabb, 1881, Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 8, p. 344.

Macrocallista (Chionella) maculata Dall, 1903, Trans. Wagner Inst. Sci., vol. 3, p. 1256.

Macrocallista maculata Maury, 1920, Bull. Amer. Paleont., No. 34, p. 68.

Macrocallista maculata Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 234, pl. 31, figs. 6, 7.

Shell rather large when adult, oval, somewhat compressed, substance porcellaneous, smooth except for fine concentric growth lines; living shells waved and spotted with violet-brown; epidermis, horny, shining. Recent specimens may attain 78 mm. in length and 58 in altitude. They show both a higher and a less elevated form, as figured by Reeve, 11a, 11b. The Trinidad fossils also show this variation of

form, but the less elevated is far commoner. Our largest fossils measure 63 in length by 44 altitude; 59 x 45; 56 x 41, and are about 12 mm. in semidiameter. Young shells measure 29 x 20 and 36 x 26 x 14 in diameter.

Comparison of these with Chipolan shells of *maculata* shows smaller specimens duplicate those from Florida, but the Trinidad Miocene shells attained a larger size than the Chipolan, being almost as large as the recent. The hinge is precisely the same as in Chipolan valves.

This species is found in the Miocene of Florida, Dominican Republic, Costa Rica and elsewhere; Pliocene of Florida and living from Hatteras through the Antilles to Brazil and in the Gulf of Mexico.

Gabb's unfigured variety *cuneata* was from Costa Rica. We have no specimens corresponding to his description.

Locality.—Springvale.

Horizon.—Upper Miocene

Genus *CALLOCARDIA* A. Adams

Subgenus *AGRIOPOMA* Dall

Callocardia (*Agriopoma*) *gatumensis* Dall Pl. 27, Figs. 5, 7

Callocardia (*Agriopoma*) *gatumensis* Dall, 1903, Trans. Wagner Inst. Sci., vol. 3, pt. 6, p. 1260, pl. 54, fig. 1.

Callocardia (*Agriopoma*) *gatumensis* Brown and Pilsbry, 1912, Proc. Acad. Nat. Sci. Phila., vol. 63, p. 370.

Callocardia (*Agriopoma*) *gatumensis* Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 235, pl. 32, fig. 1.

Shell of moderate size, ovate, thin, inflated; beaks low, incurving; lunule large, cordate; surface marked by fine, close, concentric growth lines. Length 33, height 28, diameter 17 mm. The type measured 38 x 31 x 21 and was from Gatun. The species is also recorded from Ponton, Dominican Republic; Claremont, Jamaica; and the more coarsely sculptured variety, *multifilosa* Dall, from the above localities and from the Gatun beds of Costa Rica.

Localities.—Brasso; Machapoorie quarry.

Horizons.—Brasso Miocene; Machapoorie Miocene.

Genus *PITARIA* (Roemer) Dall

As in earlier publications, I continue to use *Pitaria*, Dr. Dall's Latinized form of the African vernacular word *Pitar*. The leading French, English and American conchologists, specializing in the Veneridæ, have adopted *Pitaria*.

Section *PITARIA*, *sensu stricto*

Pitaria fulminata Menke

Pl. 27, Fig. 9

Cytherea fulminata Menke, 1830, Synopsis Molluscorum in Musco Menkeana, 2d ed. Not *C. fulminata* Philippi, 1845, nor *Venus fulminata* Valenciennes.

Pitaria fulminata Dall, 1902, Proc. U. S. Nat. Mus., vol. 26, p. 371.

This is the recent member of the Miocene-Pleistocene, *Pitaria catharinæ-subaresta* group. It ranges from Hatteras through the Antilles to Brazil, and is living on the shores of Trinidad. It attains quite a large size, a full grown Trinidad shell measuring in length 36, altitude 32, semidiameter 12 mm.

The color is cream white with radial or zigzag dashes of bright yellowish brown. The surface is marked with closely set, concentric threads; and the form is like that of *catharinæ*, but many times larger and without the slight basal sinuosity.

This is the Varying Circe of Reeve, pl. 9, fig. 39 (*Cytherea varians* Wood; *Dione varians* Deshayes) and the *Cytherea rubiginosa* of Philippi. The west coast analogue is *P. tomeana* Dall.

Another less common West Indian and northern South American recent *Pitaria* is *P. albida* Gmelin, which is squarish, elongated and pure white.

From Matura we have dwarfed shells of *P. fulminata*, the largest measuring in length 14, altitude 12, semidiameter 5 mm., and we have many recent specimens.

Localities.—Matura, on the east coast; Erin Point, on

the southwestern coast of Trinidad.

Horizons.—Upper Pliocene; Recent.

Pitaria catharinæ, n. sp.

Pl. 27, Fig. 4

Shell small, suborbicular, very plump and chubby; anterior extremity rounded, posterior end very short, roundly subtruncate; posterior basal margin very slightly sinuate. Beaks very full but low, their acute apices curving over the broadly lanceolate lunule, which is large for the size of the shell, not much depressed and bordered by a delicate line. Escutcheon not present. Surface marked with very numerous, very closely set, concentric threads which not infrequently anastomose. Hinge characters concealed. Length of specimen 18, altitude 16, diameter 12 mm.

This pretty shell is named in honor of Mrs. Katherine Van Winkle Palmer, whose fine Monograph on the *Venezidæ* will soon appear.

The affinities of *Pitaria catharinæ* are with the Pleistocene *P. subaresta* Dall, from Mt. Hope on the Isthmus, but the Trinidad fossil has very much coarser concentric lines, and the lunule, though large, is proportionately smaller than that of *subaresta*. The latter also attains a larger size.

Locality.—Ravine on east side of road about $\frac{3}{4}$ mile south of Brasso.

Horizon.—Manzanilla Miocene.

Section *HYPHANTOSOMA* Dall

The type of this section is *Pitaria carbacea* described, in 1866, by Dr. Guppy from Bowden, Jamaica, as *Cytherea carbacea*. Like all members of this section, *P. carbacea* is characterized by striking, but fine, ziczac sculpture on the surface of the shell. We have good specimens from Jamaica, and this shell is also found in the Miocene of the Dominican Republic; but it has never been collected in Trinidad.

Subgenus *HYSTEROCONCHA* Fischer*Pitaria (Hysteroconcha) dione* Linnæus

Pl. 27, Fig. 8

Venus dione Linnæus, 1758, *Systema Naturæ*, ed. X, p. 684.*Venus dione* Chemnitz, 1782, *Conch. Cab.*, 6, p. 282, pl. 27, figs. 271, 272.*Venus dione* d'Orbigny, 1845, In de La Sagra's *Historia Pol. y Nat. Isla de Cuba*, vol. 5, *Moluscos*, p. 317.*Dione veneris* Deshayes, 1853, *Cat. Conch. British Mus.*, pt. 1, *Veneridæ*.*Dione veneris* Reeve, 1863, *Conch. Icon.*, 12, *Dione*, pl. 6, fig. 23.*Pitaria (Hysteroconcha) dione*, Dall and Simpson, 1901, *Bull. U. S. Fish. Comm.*, 1, p. 485, pl. 56, figs. 3, 10.*Pitaria (Hysteroconcha) dione* Dall, 1902, *Proc. U. S. Nat. Mus.*, vol. 26, p. 371.*Pitaria (Hysteroconcha) dione* Maury, 1920, *Gulf. Moll.*, *Bull. Amer. Paleont.*, No. 34, p. 70.

This handsome shell, dedicated to Venus by Deshayes, is white tinged with purple-violet, concentrically ridged, and usually spinose on the posterior slope—but a spineless variety occurs. A good-sized shell is 40 mm. in length, 33 in altitude and 10 in semidiameter.

D'Orbigny recorded this species from the shores of Trinidad. It is elsewhere in the Antilles, and on the Texas coast southward to Colon. It is the type of the subgenus *Hysteroconcha*, the members of which inhabit tropical American seas.

Localities.—Erin Point, southwestern Trinidad; and Mayaro Point, east coast, Trinidad.

Horizon.—Recent.

Section *LAMELLICONCHA* Dall*Pitaria (Lamelliconcha) circinata* Born

Pl. 27, Figs. 12, 13

Venus circinata Born, 1780, *Testacea Musei Cæsarei Vindobonensis*, p. 61, pl. 4, fig. 8.*Venus rubra* Gmelin, 1792, *Systema Naturæ*, 6, p. 3288.*Dione circinata* Deshayes, 1853, *Cat. Conch. British Mus.*, p. 77.*Cytherea circinata* Guppy, 1867, *Proc. Sci. Assoc. Trinidad*, pt. 3, p. 162; Harris' Reprint, 1921, *Bull. Amer. Paleont.*, No. 35, p. 41.*Pitaria (Lamelliconcha) circinata* Dall, 1902, *Proc. U. S. Nat. Mus.*, vol. 26, p. 372.*Pitaria (Lamelliconcha) circinata* Dall, 1903 (in part), *Trans. Wag-*

ner Inst. Sci., vol. 3, pt. 6, p. 1269.

Pitaria (Lamelliconcha) circinata Maury, 1912, Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 15, p. 56, pl. 9, figs. 12, 13.

Pitaria (Lamelliconcha) circinata Maury, 1917 (in part), Bull. Amer. Paleont., No. 29, p. 215; Olsson, 1922 (in part), No. 39, p. 236.

This shell is common and abundant in the Antilles, on the eastern shores of Central America, and the coast of northern South America as far south as Santa Caterina, Brazil. The Pacific mutation has a more convex, larger shell, and is the variety *alternata* Broderip (Proc. Zool. Soc., p. 45, 1835).

Like all the Matura Pliocene species, the specimen of *circinata* from that locality is dwarfed, measuring only 13 mm. in length.

An extremely large shell of *circinata*, measuring in length 45, altitude 39, semidiameter 12 mm., was collected by Professor Harris at La Guayra, Venezuela. It is also on the Trinidad shores.

Localities.—Matura, northeastern Trinidad; also 1000 feet west of the Brighton pier in asphaltic marl; and La Guayra, Venezuela.

Horizons.—Pliocene and Recent.

Pitaria circinata var. *juncea* Guppy

Pl. 27, Figs. 6, 10

Cytherea juncea Guppy, 1866, Quart. Jour. Geol. Soc. London, vol. 22, p. 582, pl. 26, fig. 13.

Cytherea juncea Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 162; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 41.

Cytherea juncea Guppy, 1876, Quart. Jour. Geol. Soc. London, vol. 32, p. 531.

Cytherea juncea Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 454, p. 5; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 161.

As noted by Dr. Guppy, this form is very closely allied to *P. circinata* with which it is often united. Dr. Dall observed that the hinge of *juncea* tends to be somewhat heavier. The hinge in all our specimens is concealed. In the description of the type, the thin concentric lamellæ were alternately rather higher; but this is a variable feature, as some specimens show it very clearly and others only ante-

riorly and posteriorly.

The type of *juncea* was from Cumana, Venezuela, and Dr. Guppy also recorded the shell from the Bowden beds, Jamaica, and Springvale, Trinidad.

Locality.—Machapoorie quarry.

Horizon.—Miocene.

***Pitaria (Lamelliconcha) labreana* Maury**

Pl. 27, Fig. 11

Pitaria (Lamelliconcha) labreana Maury, 1912, Jour. Aca. Nat. Sci. Phila., 2d ser., vol. 15, p. 57, pl. 9, figs. 14, 15.

Original description.—"Shell elongate ovate, rather compressed, inequilateral, lunule small, well-defined, lanceolate; valve sculptured with narrow, round-edged lamellæ with much wider grooves between them; hinge characters shown in the figure; pallial sinus very deep, rounded, broad, extending beyond the center of the valve. Length of shell 17, height 13, diameter 6 mm."

The nearest ally of this species is the west coast, recent shell, *Pitaria concinna* Sowerby.

Localities.—1000 feet west of the Brighton pier (type locality), also in a new collection from Brighton beach, both from outcrops of impure asphaltic marl.

Horizon.—Upper Pliocene.

Genus *CYCLINELLA* Dall

***Cyclinella cyclica* Guppy**

Pl. 26, Fig. 4

Dosinia cyclica Guppy, 1866, Quart. Jour. Geol. Soc. London, vol. 22, p. 282, pl. 26, fig. 15a, b.

Dosinia cyclica Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 163; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 42.

Cyclina cyclica ? Gabb, 1873, Trans. Amer. Philos. Soc., vol. 15, p. 250. *Lucinopsis cyclicus* Guppy and Dall, 1896, Proc. U. S. Nat. Mus., vol. 19, No. 1110, p. 329.

Cyclinella cyclica Dall, 1903, Trans. Wagner Inst. Sci., vol. 3, pt. 6, p. 1285.

Dosinia cyclica Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, p. 6; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 149.

Cyclinella cyclica domingensis Pilsbry and Johnson, 1918, Proc. Acad. Nat. Sci. Phila., vol. 69, p. 200; Pilsbry, 1922, *Idem*, vol. 73, p. 424, pl. 47, fig. 8.

Shell suborbicular, varying somewhat in outline, certain specimens being truncate posteriorly and hence subquadrate in form, while others dip down a trifle at the posterior, basal margin. Surface sculpture in perfectly preserved shells, of fine, close, concentric striations with more widely-spaced coarser lines which are more apparent when the surface is somewhat worn.

Lunule clearly seen in specimens with the shell substance eroded away, lanceolate, measuring six or seven by three mm. in smaller shells; but where the surface is preserved the lunule is inconspicuous, not depressed, bordered only by a light line, rather coarsely striate, and measuring on a full-sized shell 8.5 x 4.5 mm. Hence the contradictory statements regarding the lunule, Guppy saying it was entirely wanting and Dall that it was large and lanceolate. Hinge with three cardinal teeth in each valve, central largest, right posterior bifid. Pallial sinus V-shaped, directed obliquely upwards. Length of Guppy's type 40, altitude 39 mm. Measurements of some of our specimens: 35 x 34 x 17; 30 x 28 x 14; 22 x 21 x 10 mm. The largest is imperfect but has an altitude of 40 mm.

In the early seventies, Gabb collected in Santo Domingo, a single shell which he referred with a question to this species. Pilsbry and Johnson recently described this shell of Gabb's as variety *domingensis*. But among our Trinidad collection are specimens corresponding in size, shape and surface markings to the figure of *domingensis*. The coarser concentric lines show best on somewhat worn shells, and are the occasional subrugose lines of growth among the finer striæ mentioned by Dr. Guppy in describing his type. On my expedition to Santo Domingo we did not get any *Cyclinellas*; but it seems as if Gabb's shell were a small worn specimen of *cyclica*.

The recent species in the Gulf of Mexico and from Florida to São Paulo, Brazil, is *C. tenuis* Récluz, referred to *Dosinia*, *Artemesia*, *Cyclina*, *Mysia* and *Lucinopsis*, and

in 1902 made by Dr. Dall the type of a new genus, *Cyclinella* (Nautilus, vol. 16, p. 44). The west coast species is *Cyclinella subquadrata* Hanley. The Panama Gatun Miocene form is *C. gatunensis* Dall, and in the same formation in Costa Rica are *C. beteyensis* Olsson, and *subquadrata* var. *quitana* Olsson.

Localities.—Manzanilla (type locality); also northwest corner of F 16 (eastern Trinidad).

Horizon.—Manzanilla Miocene.

Genus *CHIONE* Megerle von Mühlfeld

Section *CHIONE*, *sensu stricto*

The American species of this section have been divided by Dr. Dall into three groups with representatives in every horizon from the Miocene to the Recent. The groups are (1) That of *Chione cancellata* with trigonal shell, and concentric lamellæ rather distant; (2) that of *Chione subrostrata* Lamarck, which has the sculpture delicate and concentric lamellæ rather close and low; and (3) that of *Chione pubera* with concentric lamellæ close, very numerous and crenulate, so that the interspaces appear punctuate.

All three groups are represented in the Trinidad material.

(1) Group of *Chione cancellata*:

***Chione (Chione) cancellata* Linnæus**

Pl. 28, Figs. 1, 5

Venus cancellata Linnæus, 1767, Systema Naturæ, ed. XII, p. 1130.

Venus cingenda Dillwyn, 1817, Cat. Rec. Shells, vol. 1, p. 161.

Venus elevata Say, 1822, Jour. Acad. Nat. Sci. Phila., vol. 2, p. 272.

Venus lamellata Deshayes, 1853, Cat. Conch., British Mus., p. 134.

Not of Linnæus.

Chione cancellata Holmes, 1860, Post. Pl. Fos. S. Car., p. 35, pl. 6, fig. 14.

Venus cingenda Guppy, 1864, Trans. Sci. Assoc. Trinidad, p. 36;

Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 16; also Geol. Mag., 1864, vol. 2, pp. 256-261.

Chione cancellata Dall, 1902, Proc. U. S. Nat. Mus., vol. 26, p. 373; 1903, Trans. Wagner Inst. Sci., vol. 3, p. 1290.

Chione cancellata Maury, 1920, Bull. Amer. Paleont., No. 34, p. 72.

This attractive, abundant and variable shell, type of the section *Chione*, *sensu stricto*, has been known under many names. It is the *Venus dysera* of many authors, but not of Linnæus; and the *V. ziczac* of Moersch and Krebs, not of Linnæus; *Cardium bicolor* Martyn 1784, and *Venus maculosa* Gmelin, 1792.

The present range of *Chione cancellata* is through the Gulf of Mexico, the Antilles, Bermuda, and Cape Fear, North Caroline, to Brazil. It occurs in Pliocene beds in South Carolina and Florida. We obtained it from a depth of over two thousand feet in Pleistocene beds, in a trial oil well in Terrebonne Parish, Louisiana.

Miocene ancestral forms are *C. erosa* and *C. chipolana* Dall, both Floridian. We have many specimens from the Pliocene of Matura and very fine recent shells, one from near Farallon Rock measuring 26 x 23 and 15 in diameter.

Localities.—Matura (also recorded by Guppy as *cingenda*); Gulf of Paria near Farallon Rock; and Scotland Bay, Trinidad.

Horizons.—Upper Pliocene; Recent.

(2) Group of *Chione subrostrata*:

Chione (Chione) subrostrata Lamarck

Venus subrostrata Lamarck, 1818, Hist. des Animaux sans Vertèbres, vol. 5, p. 588; Encyclopédie Méthodique, pl. 267, fig. 7.

Venus subrostrata Reeve, 1863, Conch. Iconica, *Venus*, pl. 14, figs. 54a, 54b.

Chione (Chione) subrostrata Dall, 1902 (in part), Proc. U. S. Nat. Mus., vol. 26, p. 372; 1903, Trans. Wagner Inst. Sci., vol. 3, pt. 6, pp. 1289, 1291.

According to Reeve, the figure in the Encyclopédie to which Lamarck referred his type was *Venus lamarckii*, a Chinese species, but the type locality of *subrostrata* is stated by Lamarck to be the Antilles. Dr. Dall, in 1902, included in the synonymy of *Chione subrostrata*, *C. portesiana* d'Orbigny, 1846; *C. beauvi* Récluz, 1852; *C. crenifera* of Carpenter's Mazatlan Catalogue, and of Sowerby, 1835, and

probably also *lunularis* Philippi, 1844, not *lunularis* Lamarck, 1818.

But as our Trinidad specimens resemble very closely d'Orbigny's figure of *C. portesiana* and are unlike Reeve's of *subrostrata*, they are here referred to the former member of this group.

Chione (Chione) portesiana d'Orbigny

Pl. 28, Fig. 3

Venus Portesiana d'Orbigny, 1835-1843, Voyage dans l'Amérique Méridionale, vol. 5, pt. 3, Mollusques, p. 556; Atlas, pl. 83, figs. 1, 2.

Shell rather small, ovate-trigonal, white more or less stained with blackish ziczac or radiating markings. Described by d'Orbigny as somewhat resembling *C. pectorina* Lamarck in sculpture; but differing in its more triangular, less rounded form, its more prominent concentric ridges, and by the fact that each radial rib is composed of three or four striæ. Length of type 30 mm.

This species was collected nearly a century ago by d'Orbigny on his South America voyage and travels (1826-1833). It was named by him the Venus of the Harbors (Venus des Portes) because he found it in the Bay of Rio de Janeiro, living buried in sand at low tide level.

Our Trinidad specimens agree perfectly with d'Orbigny's figure of *portesiana*. On the center of the valves the radii are often in triads, sometimes in pairs with a third weaker, but the triad plan is most frequent. Posteriorly and at the extreme anterior the radii are single. Our largest shell measures in length 29, altitude 24, semi-diameter 7 mm.

Localities.—Shores of the Gulf of Paria and Atlantic coast, Erin Point, southern Trinidad.

Horizon.—Recent.

Chione portesiana var. **beaui** Récluz

Pl. 28, Fig. 7

Venus Beauii Récluz, 1852, Journal de Conchyliologie, vol. 3, pp. 412, 413.

We have in the Cornell Museum a specimen of *Chione beauri* collected by Dr. Newcomb from Récluz's type locality, the Island of Guadeloupe. Our shell is smaller than the type measuring in length 28, altitude 23, diameter 20 mm., while Récluz's shell was 38 x 32 x 27 mm.; but otherwise corresponds exactly to his excellent figure, even in the slight curve of the radial riblets.

The Guadeloupe shell is more convex, more angulate posteriorly than our Trinidad specimens and is also slightly sulcate and arcuate in front of the umbonal slope. It also attains a somewhat larger size. For these reasons it would seem as if the name *beauri* might be retained as a variety.

Locality.—Guadeloupe Island, W. I.

Horizon.—Recent.

Chione (Chione) dalliana Maury

Pl. 28, Fig. 10

Chione dalliana Maury, 1912, Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 15, p. 59, pl. 9, fig. 16.

Original description.—"Shell rather small for the genus, subcircular in outline; hinge characters concealed by the matrix; inner edge of valves finely crenulated; sculpture of regular, low lamellæ crossed by very fine, close-set radial striæ which with the lamellæ form a delicate cancellation over the entire surface; anteriorly the radial sculpture strengthens, forming about seven well marked plications. Length of shell 20, height 17, diameter approximately 17 mm."

This species, as I noted in 1912, is allied to the Miocene *Chione walli* Guppy, and like it is a member of the *Chione subrostrata* group. *C. dalliana* is a smaller, rounder, thinner shell than *walli*, and unlike that species is radially plicated anteriorly. Moreover, in *C. walli* the radial striæ over the center of the valve are typically in pairs, with an alternating weaker thread.

Chione dalliana is without doubt ancestral to *C. portesiana* d'Orbigny; but is not identical with that species.

A comparison of the figure of d'Orbigny's type with that of *dalliana* shows their essential differences. *C. dalliana* is smaller, rounder, more delicate with much finer sculpture, the concentric lamellæ closer, lower and finer. The anterior plications are similar, but the radials on the center of the valve are not in the form of riblets composed of triad or paired striæ, but are low, and equal. On the type of *dalliana* radials and concentric are subequal and resemble fine single threads.

The type of *dalliana* was collected by Dr. Arthur C. Veatch, in 1911, at Brighton, in an asphaltic marl then thought to be of Chipolan (Miocene) age; but later extensive studies in the field by Professor Harris have led him to conclude that the formation is much younger, probably late Pliocene.

Locality.—Along the shore 1000 feet west of the pier at Brighton, southwestern Trinidad.

Horizon.—Upper Pliocene.

Chione dalliana var. *veatchiana* Maury

Pl. 28, Fig. 14

Chione veatchiana Maury, 1912, Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 15, p. 58, pl. 9, figs. 17, 18.

Original description.—"Shell ovate-triangular, slightly rostrated posteriorly, substance rather thin; hinge characters shown in the figure; pallial sinus short, triangular; inner margin of valves finely and sharply crenate; sculpture of close-set, feeble, very slightly raised lamellæ, cancellated by slightly more conspicuous, radiating striæ. Length of shell 25, height 20, diameter 14 mm."

This has five or six weak, anterior radial plications, and over the umbonal slope the radial sculpture begins to suggest, though faintly, the riblets of paired and triad striæ of *pectorina*.

The much more elongated and trigonal form distinguishes this shell from *C. dalliana*, and the radial sculpture is somewhat stronger and foreshadows the grouping of the

striæ.

Locality.—Along the shore 1000 feet west of the pier at Brighton.

Horizon.—Upper Pliocene.

Chione dalliana var. *guppyana* Maury

Pl. 28, Figs. 4, 13

Chione guppyana Maury, 1912, Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 15, p. 59, pl. 9, fig. 19.

Original description — “Shell suborbicular, slightly obtusely pointed at the posterior end, sculpture of same general type as *C. veatchiana*—that is, finely and delicately cancellated by the intersections of radial threads with somewhat less pronounced concentric lamellæ; interior margins finely and sharply crenate; pallial sinus quite deep and obtusely triangular; hinge characters as shown in the drawing. Length of shell 19, height 16 mm.”

In form this is like *C. dalliana*, but the radial sculpture has become progressively stronger so that the paired and triad plan of the striæ, feebly shown in *veatchiana*, is much more obvious.

The type of *guppyana* was found by Dr. Veatch at Brighton, but lately Professor Harris collected some shells in the Matura beds, on the opposite side of the island, very closely resembling the type and seemingly identical in form and details of sculpture, and in the quite deep and tongue-like shape of the pallial sinus. The latter feature is very unlike the short, triangular sinus of *veatchiana*, as the drawings of the types will show.

These three related forms, *dalliana*, *veatchiana* and *guppyana*, I originally described as separate species; but here I have placed the latter two as varieties of the first, and arranged them in a series according to their development towards the detailed radial structure of the modern *C. portesiana*.

Localities.—Along the shore 700 feet east of the Brighton pier, southwestern Trinidad, in an impure asphalt (type locality); Matura beds, northeastern Trinidad.

Horizon.—Upper Pliocene.*Chione (Chione) walli* Guppy

Pl. 28, Figs. 2, 11, 15

Venus Walli Guppy, 1866, Quart. Jour. Geol. Soc. London, vol. 22, p. 581, pl. 26, fig. 16.*Venus Walli* Guppy, 1867, Proc. Sci. Assoc. Trinidad, p. 161; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 41.*Chione Walli* Dall, 1903, Trans. Wagner Inst. Sci., vol. 3, pt. 6, pp. 1291, 1587.*Chione walli* Spieker, 1922, Paleont. Zorritos Formation, pp. 151, 154.

Shell of medium size, subtrigonal, anteriorly rounded, posteriorly somewhat angulated, lunule defined by an impressed line, cordate, striate; concentric sculpture of rather prominent finely fluted ridges, at intervals of about two millimetres, radial sculpture of fine riblets, interrupted by the concentric ridges; the radiating riblets are paired on the central part of the valve and usually a smaller riblet lies between every pair, on the posterior slope the riblets are single. Length of a large shell 35, altitude 33, semidiameter 12 mm.

This handsome species is an ancestral member of the east coast *Chione subrostrata* group, but is much more strikingly like *Chione amathusia* Philippi of the Pacific shores. A shell of the latter is figured for comparison. See Plate 28, Figure 9.

In this connection, Mr. Spieker's statement is interesting. In discussing *C. variabilis* Nelson and *C. propinqua* Spieker, he says that all the Chiones, *sensu stricto*, known from the Zorritos formation of Peru have the double riblets, thus suggesting a racial affinity with *C. walli* of the Manzanilla formation.

Dr. Dall has identified *C. walli* from the Bowden beds of Jamaica.

Localities.—Manzanilla Bay, eastern Trinidad, at many collecting stations.

Horizon.—Manzanilla Miocene.

(3) Group of *Chione pubera*:

Chione (Chione) pubera Valenciennes

Pl. 29, Figs. 12, 13

- Venus pubera* Valenciennes, 1827, Name in Bory St. Vincent's Explanation of Plates, p. 152, Encyclopédie Méthodique, figs. 4, 4a.
- Venus crenulata* Reeve, 1863, Conch. Icon., *Venus*, pl. 10, fig. 33.
- Not *Venus crenulata* Chemnitz, 1782, Conch. Cab., vol. 6, p. 370, pl. 36, fig. 385. An East Indian, closely allied species. Name prior to *crenata* but Chemnitz not binomial.
- Not *Cytherea crenata* Gmelin, 1792, Systema Naturæ, vol. 6. Correct name for the East Indian shell.
- Venus superba* Guppy, 1873, Proc. Sci. Assoc. Trinidad, vol. 2, p. 91, pl. 3, fig. 2; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 74, pl. 1, fig. 2.
- Chione (Chione) pubera* Dall, 1902, Synopsis Veneridæ Proc. U. S. Nat. Mus., vol. 26, p. 374; 1903, Trans. Wagner Inst. Sci., vol. 3, pt. 6, p. 1289.
- Venus halidona* Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, p. 11; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 154.
- Not *Venus halidona* Dall, 1903, Trans. Wagner Inst. Sci., vol. 3, pt. 6, p. 1307, pl. 38, figs. 1, 1a, pt. 5, p. 1194.

Shell large, handsome, ovate-trigonal, subventricose, sculptured with closely-set, erect or slightly recurving concentric ridges which are even, regular and finely fluted, interspaces radiately striated. Living shell whitish variegated with waves of red-brown. Length of largest fossil 72, altitude 60, diameter 38 mm.; best fossil specimen, in form of a cast, length 50, altitude 39; a recent Brazilian shell 59 x 50, semidiameter 19 mm.

Dr. Guppy's *superba* was a recent shell that he collected on the beach of Cumana, Venezuela. It is undoubtedly this species, which ranges through the West Indies and along the shores of northern South America.

As far as one can judge from the material, the Trinidad fossil form is specifically identical with the living shell.

Venus halidona Dall is from the Tampa silex beds, is a true *Venus*, is smaller, and its concentric ridges are not fluted. In *Chione pubera* the fine fluting of the ridges is a very marked character and gives a punctate appearance to the shell.

Locality. — Mt. Pleasant quarry, Springvale, near

Couva, west central Trinidad.

Horizon.—Upper Miocene.

Section *CLAUSINELLA* Gray

Chione (*Clausinella*?) *sancti-davidis*, n. sp.

Pl. 28, Fig. 12

In the collection is a single worn valve of a *Chione* which is of special interest since it appears to be a representative of the section *Clausinella* which is not now living in the North American or the Antillean seas.

The shell is small, oblong-trigonal, very flat. The surface is sculptured with very round, concentric ribs, the interspaces about equalling the ribs in width. Both on the ribs and on the posterior region are distinct traces of concentric striæ. These may possibly be a deception due to wearing, but seem rather to be the fine concentric lines characteristic of the section *Clausinella*, of which the European shell, *Chione fasciata* Donovan, is the type. The Trinidad shell is much longer, with the posterior end far more produced than in *C. fasciata*, and the beak is lower and less curving. But it is quite probable that our fossil is a member of the same section. This can only be proved by more perfect specimens. Length of shell 13, altitude 11, semidiameter 3 mm.

A species of *Clausinella* is also listed by Drs. Vaughan and Woodring from the Province of Barabona, Dominican Republic.

Locality.—Matura.

Horizon.—Upper Pliocene.

Section *LIROPHORA* Conrad

Chione (*Lirophora*) *latilirata* Conrad

Pl. 29, Figs. 1, 2, 9

Venus paphia Lamarck, 1818, Anim. sans Vert., vol. 5, p. 608. Not of Linnæus, 1767.

Venus alveata Say, 1833, Am. Conch., vol. 7, pl. 63. Not of Conrad, 1831.

Venus latilirata Conrad, 1841, Proc. Acad. Nat. Sci. Phila., vol. 1, p. 28; 1845, Fos. Medial Tert., p. 68, pl. 38, fig. 3.

- Venus varicosa* Sowerby, 1853, Thes. Conch., 2, p. 723, pl. 155, fig. 67.
Circumphalus (Lirophora) athleta Conrad, 1864, Proc. Acad. Nat. Sci. Phila., pp. 575, 586.
Chione (Lirophora) latilirata Dall, 1902, Proc. U. S. Nat. Mus., vol. 26, p. 375; 1903, Trans. Wagner Inst. Sci., vol. 3, p. 1298, pl. 42, fig. 3.
Chione latilirata Glenn, 1904, Maryland Geol. Surv., Miocene, p. 309, pl. 77, figs. 3-6.
Chione latilirata Maury, 1920, Bull. Amer. Paleont., No. 34, p. 73.

This species is trigonal, flattened and sculptured with concentric ribs which, over the main part of the disc, are heavy and wide.

From the dwarf, late Pliocene, fauna of Matura, we have several small specimens, the largest being 13 mm. in length, 11 in altitude and 4 in semidiameter. From the early Pliocene, north of the Matura River, normal-sized specimens were obtained. These can be duplicated among specimens from the Cape Fear River, North Carolina.

The type locality of *latilirata* was the Miocene of Calvert Cliffs, Maryland; and the species continued on unchanged through Pliocene and Pleistocene to the Recent. The present range is from Hatteras to Rio Grande do Sul, Brazil.

Localities.—400 feet north of Matura River; also Matura.

Horizons.—Lower Pliocene; Upper Pliocene; Recent.

Chione (Lirophora) riomaturensis, n. sp.

Pl. 29, Fig. 4

We have several imperfect but interesting shells of a *Chione* which is intermediate in characters between *C. latilirata* Conrad and *C. paphia* Linnæus.

The shell is of medium size, trigonal, flat, with about four heavy, broad, flat, concentric ribs over the main part of the disc, with a number of increasingly finer riblets extending to the apex of the beak. In the broad, heavy ribbing the shell resembles *latilirata*. But posteriorly the thick ribs suddenly thin out and are continued over the posterior dorsal area as narrow, elevated ridges which extend to the border of the escutcheon.

This thinning out of the ribs is a characteristic of *C. paphia*; the ribs in *latilirata* extending in their full width as far as the escutcheon. When entire this Trinidad form would measure about 31 mm. in length, 26 in height, and 10 in semidiameter.

These specimens are not dwarfed but of normal size. The fauna of which they were members is quite independent of, and earlier than the dwarfed, late Pliocene fauna of Matura.

Locality.—400 feet north of the Matura River, eastern Trinidad.

Horizon.—Lower Pliocene.

Chione (Liophora) caroniana, n. sp.

Pl. 29, Figs. 5, 7, 8

Venus glyptocyma Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, p. 11; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 153.

Not *Chione (Liophora) glyptocyma* Dall, 1903, Trans. Wagner Inst. Sci., vol. 3, pt. 6, p. 1296, pl. 55, fig. 21.

Shell of medium size, roundly trigonal, solid, becoming robust with age, moderately convex; beaks low, acute, curving towards the striated lunule, escutcheon long, striated with growth lines, discs typically sculptured with broad, flat, irregular, concentric ribs which extend over the central portion of the valves, but anteriorly and posteriorly, on nearing the lunule and escutcheon, tend to alter suddenly into thin lamellæ. The striking feature is the coarse, broad, irregular ribbing, seemingly due to fusion. Occasionally the ribs are obsolete. Even on the beaks, the ribs are low and broad, but become wider over the discs where they vary from three to five, six or even eight millimetres in width. The largest shell measures in length 38 mm., height 30, diameter 19. An average adult is 30 x 24 x 16 mm.

This was a very common shell on the Miocene beach of Springvale.

A comparison with specimens of *Chione glyptocyma* Dall, from Oak Grove, Florida, shows a decided difference

of sculpture, the Floridian shells have more abundant and narrower ribs. In the confluence of the ribs the Trinidad species approaches more nearly to *C. burnsi* Dall, from Bailey's Ferry, Florida, but that has characteristically radial striations, as shown on our shells and Dr. Dall's figure 4 of his type. The Trinidad specimens show no trace of radial markings.

This species is related to the Miocene to Recent shell *Chione latilirata* Conrad; but the ribbing is lower, more irregular, confluent and occasionally obsolete. Our shell also is allied to the recent *Chione paphia* Linn. (*vetula* Da Costa) but in that species the broad ribs are high and recurved.

Chione chiriquiensis Olsson from the Gatun formation of Costa Rica is a miniature relative of this group which is typified by *latilirata*.

Chione ebergenyii Bose from Tuxtepec, Mexico, and *C. hendersoni* Dall from Bowden, Jamaica, are much more finely ribbed.

Locality.—Springvale, Trinidad. Very abundant.

Horizon.—Upper Miocene.

Section *TIMOCLEA* Brown

***Chione (Timoclea) pectorina* Lamarck**

Pl. 28, Figs. 6, 8

Venus pectorina Lamarck, 1818, Anim. sans Vert., vol. 5, p. 589.

Venus elegans Gray, 1828. Not of Lamarck.

Venus pectorina d'Orbigny, 1835-1843, Voyage l'Amérique Mérid., vol. 5, pt. 3, Mollusques, p. 555.

Venus pectorina Reeve, 1863, Conch. Icon., *Venus*, pl. 8, fig. 25.

Venus pectorina Guppy, 1864, Trans. Sci. Assoc. Trinidad, p. 36;

Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 16.

Chione (Timoclea) pectorina Dall, 1902, Syn. Veneridæ, Proc. U. S. Nat. Mus., vol. 26, p. 374.

This is the "heart-shaped Venus"; whitish or rusty, often with reddish, purplish or blackish markings. The sculpture is of very numerous fine, equal, sharp radiating threads, alternating with almost microscopic radial striæ, crossed by very fine concentric raised lines, making, under

the lens, a beautiful and intricate lattice-work. Our largest shell measures in length 33, altitude 29, diameter 21 mm.

D'Orbigny found this *Timoclea* very abundant in the sands at lowest tide level in the Bay of Rio de Janeiro. It ranges from the Antilles to São Paulo, Brazil. Dr. Guppy recorded it from the Matura beds.

Localities.—Shores of Gulf of Paria, Trinidad, and Matura beds.

Horizons.—Upper Pliocene and Recent.

Genus *ANOMALOCARDIA* Schumacher

Anomalocardia brasiliiana Gmelin

Pl. 29, Figs. 10, 11

Venus brasiliiana Gmelin, 1792, Syst. Naturæ, 6, p. 3289.

Venus flexuosa Born, 1780, Test. Mus. Vind., p. 62, pl. 4, fig. 10. Not of Linnæus, 1767.

Cytherea macrodon Lamarck, 1818, Anim. sans Vert., vol. 5, p. 580.

Cytherea lunularis Lamarck, 1818, *Idem*, p. 580.

Venus macrodon Hanley, 1843, Biv. Shells, p. 116, pl. 9, fig. 7; Sowerby, 1853, Thes. Conch., 2, p. 717, pl. 156, fig. 88.

Venus lunularis Philippi, 1844, Abb. und Beschr., vol. 1, p. 177, pl. 3, fig. 10.

Venus macrodon Guppy, 1864, Trans. Sci. Assoc. Trinidad, p. 36; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 16.

Anomalocardia brasiliiana Dall, 1902, Proc. U. S. Nat. Mus., vol. 26, p. 375; 1903, Trans. Wagner Inst. Sci., vol. 3, pt. 6, p. 1306.

Anomalocardia brasiliiana Maury, 1920, Gulf. Moll., Bull. Amer. Paleont., No. 34, p. 75.

On Freeport-Todd's road many *Anomalocardias* were collected which comparison shows are identical with the recent *A. brasiliiana* Lamarck. This species is variable assuming a short, high and a long, produced form. Often there is a slight basal emargination in front of the umbonal slope. The sculpture is of concentric ripples conspicuous anteriorly and some times present posteriorly but obsolete on the center of the valve which is smooth. Nearly all the Freeport-Todd's road specimens are the high form, an average shell measuring in length 22, altitude 18, semi-diameter 7.5 mm.

Like all the Matura molluses, the specimens from there are dwarfed, but show both the high and low form.

A very large, elongated, recent Brazilian specimen is 41 in length, 28 in altitude and 11 in semidiameter, and a short shell is 30 x 29 x 10. But we have smaller ones that match the Trinidad fossils. Living shells are white, or creamy, delicately painted with violet in ziczac and arabesque designs.

Localities.—Freeport-Todd's road, associated with *Arca patricia*, near the 2d mile post; and $\frac{1}{4}$ mile south of the 6th mile post; also at Matura.

Horizons.—Upper Miocene (*Arca patricia* horizon); Upper Pliocene; Recent.

Genus *THYASIRA* (Leach) Lamarck

Thyasira sancti-andreae, n. sp.

Plate 30, Fig's 2,3

Shell rather large, moderately inflated, subtrigonal with a rounded base; and markedly concave dorsally, anterior to the beaks. Substance extremely thin. Surface smooth except for fine, concentric growth lines. Beaks full but low, their apices very small, sharply pointed, strongly prosogyrate. Anterior dorsal area with a cordate lunule, more or less impressed in different individuals. Posterior area with a delicate but clearly defined, linear, radial plication passing from behind the beak towards the base, but usually fading out before reaching the posterior basal margin. Hinge characters concealed. The largest shell measures in length 45 mm., the smallest 15, the most perfect is 40, 34 in altitude and 23 in diameter.

Dr. Dall most kindly helped in determining the generic position of this puzzling shell. He writes: "I have carefully examined your shell, and by removing one side of it with acid the matrix seems to show a Lucinoid entire pallial line and muscular impression. I think the genus is *Thyasira* . . . If my surmise is correct there should be only a small knob in the hinge under the beaks."

This species is common at collecting station No. 316, at Manzanilla, where 20 specimens were obtained. Many

are much distorted from pressure to which the strata have been subjected.

Dr. Dall likens this shell to the very much smaller *Thyasira sarsii* Philippi, which he says might be a miniature of the Trinidad fossil. *T. sarsii* is known from north Europe and Greenland, but not from America east, or west. So the relationship of the Manzanilla species is with a boreal, Atlantic recent form.

The Godineau River beds of Trinidad contain *Thyasira adoccasa* Van Winkle, known only in the form of internal molds, attaining a maximum length of 123 mm. Its nearest ally is *Thyasira bisecta* Conrad, Miocene to Recent, on the west coast of the United States.

In the Pliocene of Florida is *Thyasira trisinuata* d'Orbigny; and in the Pleistocene of northeastern North America is *T. gouldii*. Both these species are still living, the latter extending south as far as Martinique in the West Indies. But it is a lover of the cold and becomes larger to the north and in the deeps. The distribution of these two species suggests a circumpolar origin as they inhabit also the North Pacific.

Locality.—Manzanilla.

Horizon.—Manzanilla Miocene.

Genus *PHACOIDES* Blainville

Subgenus *LUCINISCA* Dall

Phacoides (Lucinisca) roigi, n. sp.

Pl. 29, Fig. 6

Shell resembling the recent, West Indian, *Phacoides (Lucinisca) muricatus* Spengler; but differing in the ribbing which is much sparser and more spinose than in the living shell. In our specimens of "*L. scabra*" (*muricatus*) as well as those of *muricatus*, the ribbing is exceedingly close, even more so than represented by Reeve's figure (pl. 8, fig. 45)—there being about fifty ribs. But in the Trinidad

fossil shells there are only about twenty-five counting in the smaller intercalary riblets that frequently, but not always, alternate with the larger ribs. The ribs are ornamented with very conspicuous hollow vaulted scales—much more pronounced than in the recent *muricatus*—so that the surface appears covered with thorny spines. The dentition is similar to that of *muricatus*. Length of shell 11, altitude 10.5, semidiameter 2 mm.

The only two recent, east coast and Antillean members of *Lucinisca* given in Dr. Dall's Synopsis of the *Lucinacea*, are *muricatus* (Spengler) and *nassula* Conrad. In the latter the concentric equals the radial sculpture, forming a nearly uniform reticulation and the spines are not prominent. In *muricatus* and in our fossil the concentric sculpture is hardly apparent—except on the umbo of our shell where two or three concentric lines appear, preceding the radials, which then develop, the concentrics becoming obsolete.

Phacoides (*Lucinisca*) *cercadicus* Maury, from the Cercado formation, Dominican Republic, is not spinose, but beaded at the intersections of the radial and concentric riblets, while *L. hoveyi* Maury, from the Miocene, Quebradillas limestone of Porto Rico, is finely latticed and has no secondary riblets.

This very beautiful shell is named in honor of Dr. Mario Sanchez Roig, of Havana, in recognition of his recent fine Memoir on the Fossil Echinoderms of Cuba.

Locality.—Matura, eastern Trinidad.

Horizon.—Pliocene.

Genus *CHAMA* (Linnæus) Bruguière

Chama involuta Guppy

Pl. 29, Fig. 3

Chama involuta Guppy, 1873, Proc. Sci. Assoc. Trinidad, vol. 2, p. 86, pl. 2, fig. 5; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 70.

Chama involuta Guppy, 1874, Geol. Mag., London, p. 436, pl. 17, figs. 5a-c.

Chama involuta Guppy, 1876, Quart. Jour. Geol. Soc. London, vol. 32,

p. 531.

Chama involuta Dall, 1903, Trans. Wagner Inst. Sci., vol. 3, pp. 1398, 1586.

Chama involuta Maury, 1917, Bull. Amer. Paleont., No. 29, p. 199, pl. 33, figs. 4, 5, 6.

Chama involuta Pilsbry, 1922, Jour. Acad. Nat. Sci. Phila., vol. 73, p. 416.

In the Trinidad collection is a *Chama* valve of the same form and size and with the prominent, extremely spiral, *Diceras*-like beak of *Chama involuta* Guppy. If complete it would measure about 22 mm. in length.

The specimen is a convex, left valve with the scar of attachment below the beak. The surface is covered with granose ridges, and remains of the larger, more or less erect scales; but the shell is not as well preserved as those I figured from the Dominican Republic, in Bulletin 29, to which the reader is referred.

Mr. Vendryes collected the type in Jamaica and sent it to Dr. Guppy for description. It has never before been recorded from Trinidad.

Locality.—Brasso Creek.

Horizon.—Manzanilla Miocene.

Genus *ECHINOCHAMA* Fischer

Echinochama yaquensis Maury

Chama arcinella Moore, 1853, Quart. Jour. Geol. Soc. London, vol. 9, p. 130. Not *arcinella* Linnæus.

Chama arcinella Guppy, 1866, Quart. Jour. Geol. Soc., vol. 22, p. 294.

Chama arcinella Gabb, 1873, Trans. Amer. Phil. Soc., vol. 15, p. 251.

Chama arcinella Guppy, 1874, Geol. Mag., London, p. 442.

Echinochama antiquata Maury, 1917, Bull. Amer. Paleont., No. 29, p. 201, pl. 33, fig. 10. Not *antiquata* Dall.

Echinochama antiquata var. *yaquensis* Maury, 1917, Bull. 29, p. 201, pl. 33, figs. 11, 12.

Echinochama trachyderma Pilsbry and Johnson, 1917, Proc. Acad. Nat. Sci. Phila., p. 197.

Echinochama yaquensis trachyderma Pilsbry, 1922 (Jan.), Proc. Acad. Nat. Sci. Phila., vol. 73, p. 416.

Echinochama yaquensis Olsson, 1922 (June), Bull. Amer. Paleont., No. 39, p. 219, pl. 28, fig. 5.

The Dominican Chamas were very puzzling and Mr. Olsson is probably correct in regarding my *antiquata* as

merely a larger *yaquensis*.

The true *antiquata* Dall, is from Bowden, Jamaica, and from the Gatun stage of Costa Rica.

In the Trinidad material is a fragmentary specimen which shows the characteristic pustulose surface and the form of the umbonal region of *E. yaquensis*. But it is too incomplete to figure and the reader is referred to the illustrations of the *Dominican* type in Bulletin 29, from the Gurabo formation.

E. yaquensis has been found by Mr. Olsson in the lower Gatun of Old Harbor, Costa Rica.

Locality.—Brasso Venada Ravine, 3 miles east of Brasso Station.

Horizon.—Manzanilla Miocene.

Genus *CARDITA* (Bruguière) Lamarck

Section *CARDITAMERA* Conrad

Cardita (*Carditamera*) *guppyi* Dall

Cardita minima "Sowerby", Guppy, 1867, Geol. Mag., London, p. 18.

Cardita minima Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 163; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 42.

Not *Cardita minima* Reuss, 1844, Böhm Kreidef., vol. 2, p. 14, pl. 33, fig. 14.

Cardita (*Carditamera*) *Guppyi* Dall, 1903, Trans. Wagner Inst. Sci., vol. 3, p. 1413, pl. 56, fig. 3.

Shell minute, trapezoidal, with about fourteen rounded riblets, coarsely crenulated, and separated by narrower interspaces; beaks low, inconspicuous. Larger specimens are 4 mm. in length and 3 in height.

Fide Dr. Dall, there is no *Cardita minima* of Sowerby, and at any rate that specific name was preoccupied by Reuss.

Locality.—Matura; abundant.

Horizon.—Pliocene.

Cardita (*Carditamera*) *virginiae* Maury

Cardita (*Carditamera*) *virginiae* Maury, 1912, Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 15, p. 53, pl. 9, figs. 2, 3.

Shell rather small, elongate-elliptical, beaks low, at the anterior fourth of the entire length of the valve; sculpture of fifteen or sixteen well-defined ribs, which anteriorly are regularly and closely crenulated, but posteriorly smooth, or nearly so. Length 13, height 7 mm.

Locality.—Brighton, southern main road just south of Pitch Lake, in a yellowish-brown, ferruginous marl.

Horizon.—Upper Miocene, a little younger than Springvale.

Genus *VENERICARDIA* Lamarck

Venericardia terryi var. *brassica*, n. var.

Pl. 30, Fig. 5

Shell of moderate size, ovately cordate, convex; beaks situated very anteriorly, very high and full but with extremely small, acute apices very much curved and inclining over the exceedingly small lunule. Surface sculptured with seventeen to eighteen low, radial ribs which are narrow over the umbonal region, the anterior showing subacute ridges; but over the central part of the valves the ribs become rounded, wide, flat and undulating, with interspaces merely linear. Length of most perfect specimen 27, height 30, diameter 20 mm. A larger, worn shell is 32 x 37 x 27 mm.

This species is very closely akin to *Venericardia terryi* Olsson, from the Gatun Miocene of Costa Rica; but the Trinidad shell has more numerous ribs, is higher and fuller in the umbonal region and is larger. A comparison with Mr. Olsson's types show that they are more circular and less ovate in outline, and have twelve to thirteen against seventeen to eighteen ribs. Both these forms are ancestral to the recent Pacific *Venericardia crassicostata* Sowerby.

Localities.—Brasso Junction; and top of Brasso section, No. 284.

Horizon.—Brasso Miocene.

Vencricardia trinidadensis, n. sp.

Pl. 30, Fig. 6

Shell cordate, inflated, with umbones full and high, their apices small, pointed, incurved; surface ornamented with eighteen high, sharp, narrow, radial ribs coarsely and rather irregularly nodose. The anterior and central ribs have on either side a fine radial thread. Interspaces deeply and roundly channelled and marked with concentric growth lines. We have many specimens—small shells from 12 mm. in length, 11 in height and 8 in diameter; 23x20x17, to a large valve 30 in length by 28 in height. A perfect right adult valve measures 26 in length, 25 in height, and 12 semidiameter.

Adolescent shells of this species resemble *Venericardia scabricostata* Guppy, from the Miocene of Jamaica, Santo Domingo and Costa Rica; but the Trinidad shell can be distinguished by the auxiliary radial threads on either side of the anterior and central ribs. These threads are not present in *scabricostata*; and in that species the crenulation of the ribs is fine and regular while in this it is coarsely nodular.

In some respects this Trinidad shell recalls the Dominican Miocene *V. cerrogordensis* Maury, but that is very much flatter, with low beaks, and low ribs, and the auxiliary, radial threads form weak keels on either side of the ribs.

Localities.—Upper Poole Road (central Trinidad); Guaico-Tamana Road; Machapoorie quarry; Fossil Ravine (central Trinidad); Brasso-Tamana Road near 4½ mile post; also Brasso Venada Ravine.

Horizons.—All Machapoorie Miocene except the last locality, which is Manzanilla Miocene.

Genus *ERYCINELLA* Conrad

Subgenus *CARDITOPSIS* Smith

Erycinella (Carditopsis) guppyi, n. sp.

Pl. 27, Fig. 14

Shell extremely minute, subquadrate, very inequilateral, beaks low, very anteriorly situated; exterior of shell boldly

radially sculptured; interior shining, with the exterior sculpture reflected by conspicuous, riblike, radiating rays, inner margins strongly dentate. The exterior of the valve is sculptured with nine strong, rounded, nodose, radial ribs and a tenth, much weaker, near the posterior dorsal margin. Interspaces narrow, deeply channeled. Hinge of left valve with two cardinal teeth, a resilium between them, a long anterior lateral ridge and a posterior lateral groove and socket. Length of shell 2.5 mm., height 2 mm.

This tiny shell is of a rare genus, a member of Bernard's family *Condyllocardiidae*, comprising minute relatives of the *Carditidae* which, when adult, retain hinge characters of nepionic shells of *Cardita*. The genotype of *Erycinella* is *E. ovalis* Conrad, from the Virginian Miocene, which our shell is unlike in form and sculpture. This Trinidad species is much nearer *E. (Carditopsis) bernardi* Dall, from the Pliocene of Costa Rica; but that species has more numerous ribs (14), the beak is not so anteriorly placed, and the form is less quadrate.

Locality.—Matura.

Horizon.—Pliocene.

Genus *CORBICULA* Megerle

Subgenus *CYANOCYCLAS* Férussac

This subgenus is limited to and characteristic of the streams of Central and South America and Mexico.

Corbicula (Cyanocyclus) comparana, n. sp.

Pl. 30, Figs. 1, 4, 8, 10, 11, 12

Shell subtrigonal, moderately inflated, with very high and pointed beaks. Substance rather thin. Surface marked with fine, concentric growth lines. Teeth strong, the posterior lateral very long. A young specimen measures in length 19, height 20, diameter 12; and a large shell is 30 x 32 x 21 mm.

The distinguishing character of this species is its tri-

gonal form and very high pointed beak. In old shells, however, the umbo is usually eroded from the action of CO₂ in the river water. In its form, this species has quite a striking resemblance to *Corbicula oleana* Marshall, of the recent South American fauna.

Specimens from Comparo Road can be exactly matched among those from Cedros Point. In both localities the shells are abundant, and show that this species lived in Pliocene times in streams on both sides of the Island.

This may be the shell that Dr. Guppy, in 1908, (Bull. Misc. Inform. Botanical Dept. Trinidad, p. 114) referred to *Cyrena semistriata* Deshayes, but it is not the true *C. semistriata* of Europe.

Localities.— $\frac{1}{2}$ mile on Comparo Road near Sangre Grande, N. E. Trinidad; shore near Cedros Point, S. W. Trinidad.

Horizon.—Lower Pliocene.

***Corbicula (Cyanocyclas) coubarillia*, n. sp.**

Pl. 30, Fig. 7

Shell subcircular, nearly equilateral, moderately and evenly inflated. Beaks low. Entire surface sculptured with fine, narrow, concentric ridges, and about five growth stages are indicated. Hinge and interior concealed. A mold measures in length 26, altitude 27, diameter 24 mm.

This species is distinguished from our other Trinidad *Corbiculas* by its low beak and rounded form, which may be likened to that of the recent Uruguayan, *Corbicula circularis* Marshall.

Locality.—Point Coubaril, Brighton.

Horizon.—Lower Pliocene.

***Corbicula (Cyanocyclas) caroniana*, n. sp.**

Pl. 30, Fig. 9

Shell roundly cordate, evenly and gently convex; anterior end much shorter than the posterior, the shell being decidedly inequilateral. Beaks moderately high. Sculpture of fine, concentric lines. Cardinal teeth strong, and laterals

long and well developed. Largest specimen imperfect but about 26 mm. in length and 25 in altitude. A small, perfect shell is in length 19, altitude 18, diameter 13 mm. This species is characterized by its medium beak and sub-rotund form. It may be likened in general form to the recent *Corbicula compacta* Marshall, from Uruguay.

Locality.—Freeport-Todd's Road at $\frac{1}{2}$ mile post; also $\frac{1}{4}$ mile south of the 6th mile post.

Horizon. — Upper Miocene. Associated with *Arca patricia* and *Anomalocardia brasiliensis*.

Genus *CRASSATELLITES* Krüger

Section *SCAMBULA* (Conrad) Dall

Crassatellites (*Scambula*) *trinitarius*, n. sp.

Pl. 31, Figs. 1, 7

Crassatella melina Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 454, p. 8; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 164.

Not *Crassatella melina* Conrad, 1832, Foss. Tert. Form., p. 23, pl. 9, fig. 2.

Shell elongate, not much inflated, substance solid and thick, very inequilateral, the anterior end very much the shorter; valves equal; anterior end rounded, posterior produced, bluntly pointed, briefly truncated. Lunules impressed. Beaks low, their apices flattened, with about seven, concentric waves. The surface of the rest of the shell on the anterior area is very finely concentrically ribbed, the riblets resembling fine threads. Central and posterior areas smooth except for growth lines. The posterior dorsal area is bordered by a narrow, radial ridge and on the umbonal slope is a weak carina, in front of which the valve tends to be sulcated, although some specimens are not. Length of adult 53, altitude 32, diameter 17 mm.; a young shell is 38 x 23 x 13 mm.

Dr. Guppy referred a specimen he collected at Springvale to *Crassatellites melinus* Conrad; but the type locality of that species is the Miocene of New Jersey; and our shell is quite different in shape, being very much more elongate

posteriorly, and smoother than Conrad's.

In the recent Antillian fauna the genus *Crassatellites* is represented by *C. antillarum* Reeve, extremely rare, and never found as a fossil. The accepted locality of the type is Margarita Island, which Dr. Dall somewhat doubts. Another representative is *C. gibbesi* Tuomey and Holmes (*=floridanus* Dall, young specimen), appearing in the Upper Miocene of Carolina and living from Cape Hatteras to Barbados. It attains 65 mm. in length, and the entire surface is very finely, concentrically ribbed.

Locality.—Springvale.

Horizon.—Upper Miocene.

Crassatellites (*Scambula*) *montserratensis*, n. sp.

Pl. 31, Fig. 3

From Springvale we have a *Crassatellites* of different form from the preceding. The shell is proportionately shorter and higher, with a greater thickness; the umbonal region is much more inflated, and the five or six concentric waves on the beak are very much coarser, more distant and heavier. The vales are unequal, the left being more convex, but this inequality may be in part due to pressure. The umbonal slope is strongly carinate, and the posterior end of the shell is short, so that the anterior and posterior areas are subequal in length; but while the anterior is evenly convex, the posterior is sulcate in front of the carina. The beaks are nearly central. The surface below the rippled beaks is marked only with concentric growth lines. Length 58, estimated height 39, diameter 23 mm.

This shell has somewhat the form of *C. melinus* var. *meridionalis* Dall, but the umbonal region is higher and fuller, and the umbonal waves much coarser, fewer, and more distant in the Trinidad shell.

Locality.—Springvale, in the quarry which is on a spur of the Monsterrat range.

Horizon.—Upper Miocene.

Genus *CRASSINELLA* Guppy*Crassinella guppyi* Dall

Pl. 31, Fig. 5

Crassinella miocenica Guppy, MS.*Crassatellites (Crassinella) Guppyi* Dall, 1896, Proc. U. S. Nat. Mus., vol. 19, No. 1110, p. 326, pl. 30, fig. 5; 1903, Trans. Wagner Inst. Sci., vol. 3, pt. 6, p. 1476.*Crassinella guppyi* Guppy, 1910, Agric. Soc. Trinidad and Tobago, Paper No. 440, p. 7; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 149.

Shell extremely small, flat, roundly trigonal, with ten to twelve concentric lamellar ridges, much narrower than their interspaces. Altitude of type 4.6, longitude 4.6 mm. Type locality, Miocene of Bowden, Jamaica. Our largest Trinidad specimen is 5 x 5 mm.

This striking little shell is generally lopsided, as shown in the figure of the type; in this respect resembling the larger Recent and Miocene species *C. guadalupensis* d'Orbigny.

Locality.—Springvale.

Horizon.—Upper Miocene.

Crassinella guadalupensis d'Orbigny

Pl. 31, Figs. 4, 6

Crassatella guadalupensis d'Orbigny, 1845, In de la Sagra's Hist. Fisica, Politica y Natural de la Isla de Cuba, pt. 2, vol. 5, *Moluscos*, p. 326, Atlas, pl. 27, figs. 24–26.

Shell small, greatly compressed, white or purplish, concentrically ribbed, riblets high, equidistant; interspaces ridged; anterior end short, posterior produced. Length of type a trifle over 5 mm.

This species d'Orbigny recorded from Cuba, Guadeloupe, Santo Domingo, St. Thomas, and elsewhere in the Antilles.

We have many *Crassinellas* from Matura, ranging from two to over five millimetres in length. They tend to have more ribs than the Springvale examples and to develop secondary riblets in the interspaces which is characteristic of d'Orbigny's *C. guadalupensis*. Many also have the

unsymmetrical form of the latter shell.

Locality.—Matura.

Horizon.—Upper Pliocene. Also in the recent fauna.

***Crassinella martinicensis* d'Orbigny**

Pl. 31, Fig. 2

Crassatella martinicensis d'Orbigny, 1845, In de la Sagra's Hist. Física, Pol. y Nat. de la Isla de Cuba, pt. 2, vol. 5, *Moluscos*, p. 325, Atlas, pl. 27, figs. 21–23.

Astarte (Gouldia) martinicensis Guppy, 1864, Trans. Sci. Assoc. Trinidad, p. 36; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 26.

Gouldia martinicensis Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 162; Harris' Reprint, 1921, Bull. 35, p. 41.

Crassinella Martinicensis Guppy, 1874, Geol. Mag., London, p. 442.

This species is distinguished from *C. guadalupensis* by its bilateral symmetry. The anterior and posterior ends are so nearly equal that the shell has the form of a diminutive isosceles triangle, or of a Greek Delta, with the base a segment of an arc instead of a straight line.

Professor Harris obtained recent specimens by dredging in the Gulf of Paria, off the west coast of Trinidad, which agree perfectly with those from the east coast Pliocene beds. A large Pliocene specimen is 5 mm. in length and 5 in altitude.

Localities.—Matura; Gulf of Paria.

Horizons.—Upper Pliocene; Recent.

Genus **THRACIA** Blainville

Sugenus **CYATHODONTA** Conrad

***Thracia (Cyathodonta) semirugosa* Reeve**

Thracia plicata Reeve, 1859, Conch. Icon., *Thracia*, pl. 2, fig. 7a. Not *plicata* Deshayes, from Senegal, 1832.

Thracia semirugosa Reeve, 1859, Conch. Icon., *Thracia*, notes to pl. 2, fig. 7, West Indies.

Thracia dissinilis Guppy, 1874, Ann. and Mag. Nat. Hist., 4th ser., vol. 15, p. 52.

Ovate-oblong, compressed, roughened by radiating lines of fine granules, surface with strong concentric ripples. Length 40, height 27, diameter 15 mm.

Dr. Dall unites Guppy's *dissimilis* with *semirugosa* Reeve.

Locality.—Coast of Trinidad (Guppy).

Horizon.—Recent; Pliocene of Florida.

Thracia (*Cyathodonta*) *meridionalis* Guppy

Pl. 31, Fig. 9

Raëta meridionalis Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 454, p. 8, pl. 3, fig. 1; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 164, pl. 8, fig. 1.

In our material from the type locality of this species are two valves apparently similar to Dr. Guppy's *Raëta meridionalis*. The shell is oblong-oval, rather compressed, very thin and papery in substance; the entire surface waved in concentric undulations. Neither Dr. Guppy's specimens nor ours show the hinge characters and the shells are incomplete; but I am disposed to put this species in *Cyathodonta* rather than in *Raëta* because of the details of sculpture. In *Raëta* the undulations are very finely transversely marked with vermiculate striæ, but the Trinidad fossil has much coarser streaks, like those of a paint brush when the paint is too thin. These markings are in general longitudinal but at variance with the undulations and are like the marking on *Cyathodonta tristani* Olsson. Moreover, in our fossil there is a change of direction in the undulations in the center of the valve which also may occur in *Cyathodonta*. Estimated length of largest specimen when complete 44, height 32, diameter 14 mm.

This species is closest to *Cyathodonta tristani* Olsson, from the Gatun of Costa Rica. From the Tertiary of Guadeloupe Island, Dr. Dall described *C. guadalupensis* and *C. spenceri*. *C. vicksburgiana* Dall, from the Oligocene of Mississippi, is quite similar in form to *C. reedsi* Maury, from the Porto Rican Miocene—these two forming a group very unlike the other species mentioned.

Locality.—Springvale.

Horizon.—Upper Miocene.

Genus *PHOLADOMYA* Sowerby

The genus *Pholadomya* began in the Lias, culminated during the Mesozoic, became rare in the Tertiary, and in the Recent is represented by only two species—*Pholadomya candida* Sowerby, the genotype, from the Island of Tortola in the West Indies, and an Oriental species living in the Japanese seas. The *Pholadomya arata* of Verrill, dredged off Martha's Vineyard, Mass., was placed by Dall in *Aporema*—a genus created by Dall for this Vineyard species.

The rare Tertiary genus, *Phenacomya* Dall (Trans. Wagner Inst. Sci., vol. 3, p. 823, footnote) of which the type is *Phenacomya cuneata* Sby. (Deshayes, Anim. sans Vert. Bassin de Paris, vol. 1, p. 277, pl. 9, figs. 6–8, 1869) includes but two American species—*Phenacomya petrosa* Conrad and *P. mauryi* Harris (Bull. Amer. Paleont., No. 4, p. 71, pl. 6, fig. 17, 17a, 1896).

I have never before found *Pholadomya* in the Antillean Miocene, but species are present in beds of that age in Venezuela.

***Pholadomya walli*, n. sp.**

Pl. 31, Figs. 8, 11

We have a single imperfect cast of the anterior portion of a *Pholadomya* which, although incomplete, seems worthy of description because of the present and Tertiary rarity of the genus.

The shell is large, when complete oblong-ovate, exceedingly ventricose. Beaks low, touching, very full, extremely far forward in position. Anteriorly and posteriorly, as far as the fragment extends, the surface is sculptured with concentric ribs, narrow and close proximally but becoming coarser and less regular distally. This concentric ribbing does not, however, extend over the posterior dorsal area which is concave and smooth. A short distance back from the anterior end the radial sculpture commences and consists of coarse, not perfectly regular, narrow ribs which pass obliquely from the umbo to the basal margin. The

radial ribs equal the concentric and form with them a coarse, oblique cancellation over the anterior—central part of the shell. Although the entire posterior portion of the specimen is missing, one can see from the umbonal region that radials did not extend over the posterior region of the shell. Length unknown, height 50, diameter 45 mm.

When entire, this must have been a fine shell, approaching in size the Maryland Eocene *Pholadomya marylandica* Conrad; but much shorter anteriorly, and very much more boldly and handsomely sculptured.

This rare shell is named in memory, and in honor of G. P. Wall, pioneer geologist of Trinidad, and director of the first geological survey of the West Indies.

Locality.—Guaico-Tamana Road quarry.

Horizon.—Machapoorie Miocene.

Pholadomya sawkinsi, n. sp.

Pl. 31, Fig. 10

Shell much smaller than the preceding species, transversely oblong, widely gaping posteriorly. Beaks situated very far forward. Anterior end very short, posterior end much produced. Some of the original substance still remains upon the mold and indicates that the shell was very thin. The surface is sculptured with unequal, uneven, concentric ridges which fade out on reaching the posterior dorsal area. The radial sculpture consists of irregular, unequal, oblique ribs which extend from about the anterior fourth of the shell to the region of the umbonal slope, in front of which they cease. Length 45, height anteriorly 15, posteriorly 25, diameter 25 mm.

This species may be likened in size and general aspect to some forms assumed by the recent *Pholadomya candida*, as that figured by Tryon (Struct. and Syst. Conch., pl. 108, fig. 76). Our Newcomb collection specimen of *candida* is not so much like the fossil, but members of *Pholadomya*, as of all boring genera, vary with their individual habitat. And we may regard this fossil as the Miocene ancestor of

the living Antillean species.

This shell is named in memory, and in honor of James G. Sawkins, the colleague of Wall on the first West Indian survey.

Locality.—Machapoorie quarry.

Horizon.—Machapoorie Miocene, which is next but one to the base of the Lower Miocene series of Trinidad.

CLASS SCAPHOPODA

Genus *CADULUS* Philippi

Cadulus parianus Guppy

Cadulus parianus Guppy, 1896, Proc. U. S. Nat. Mus., vol. 19, p. 325, pl. 30, fig. 7.

These shells were formerly referred to *Ditrupa* by Dr. Guppy, who thought them the tubes of this Annelid worm; but they are Scaphopod shells.

Horizon.—Miocene.

CLASS GASTROPODA

Genus *CARINARIA* Lamarck

Carinaria caperata Guppy

Carinaria caperata Guppy, 1896, Proc. U. S. Nat. Mus., vol. 19, p. 318, pl. 27, fig. 14.

Locality.—Shell bed, Ally Creek, Naparima (Guppy).

Horizon.—Miocene.

Genus *TEREBRA* Adanson

Terebra sulcifera Sowerby

Pl. 32, Fig. 3

Terebra sulcifera Sowerby, 1849, Quart. Jour. Geol. Soc. London, vol. 5, p. 47.

Terebra sulcifera Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 158; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 37.

Terebru robusta Gabb, 1873, *pro parte*, Trans Amer. Philos. Soc., vol. 15, p. 224.

Not *Terebra robusta* Hinds, 1843, Proc. Zool. Soc., p. 149.

Terebra sulcifera Guppy, 1874, Geol. Mag., London, p. 439.

Terebra sulcifera Guppy, 1876, *pro parte* Quart. Jour. Geol. Soc., London, vol. 32, p. 525, pl. 29, fig. 8.

Terebra sulcifera Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 454, pp. 4, 8; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, pp. 161, 164.

Terebra sulcifera Maury, 1917, Bull. Amer. Paleont., No. 29, p. 22, pl. 3, figs. 12, 13.

Typical, Dominican, specimens of *T. sulcifera* Sowerby, have the earlier whorls with two upper bands, both obliquely striated, and the second about half the width of the first, followed by a vertically striated area. On the later whorls the banding becomes obsolete. The columella is uniplicate.

The Springvale specimens have the second band very narrow, hardly more than a heavy, raised cord, and the lower area correspondingly wider. The columella, as far as can be seen, appears to have a single plication. A fragment of four lower whorls measures 55 x 18 mm.

It is rather curious that specimens of *T. sulcifera* from the Chipolan Miocene of Florida should, like these from Trinidad, have the second band on each volution narrower than is typical.

A specimen from near Brasso has the division between the two upper bands ill-defined; it measures 40 x 15 mm. and includes 6 whorls.

This species is also in the Bowden beds, Jamaica.

Localities.—Springvale; Brasso Venada Ravine.

Horizons.—Springvale Miocene; Manzanilla Miocene.

***Terebra bipartita* Sowerby**

Pl. 32, Fig. 2

Terebra bipartita Sowerby, 1849, Quart. Jour. Geol. Soc. London, vol. 5, p. 47.

Terebra bipartita Gabb, 1873, Trans. Amer. Philos. Soc., vol. 15, p. 225.

Terebra (Acus) bipartita Dall, 1895, Proc. U. S. Nat. Mus., vol. 18, No. 1035, p. 38.

Terebra bipartita Maury, 1917, Bull. Amer. Paleont., No. 29, p. 23, pl. 3, fig. 14.

Terebra bipartita Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 35, pl. 1, figs. 1, 2.

This species has every volution divided into nearly equal halves. The columella is biplicate. A Trinidad fragment of five lower whorls measures 51 x 18 mm.

Dr. Guppy united *T. bipartita* with *sulcifera* and *inæqualis*—but erroneously, for the columellar plications as well as the sculpture indicate a difference. *T. bipartita*, *oligomitra*, *spirifera* and *cirrus* form a biplicate group; and *T. sulcifera*, *inæqualis* and *isaacpetiti* a uniplicate group.

T. biplicata was first collected in the Dominican Republic by Colonel Heneken. It is also in the Chipolan Miocene of Florida, and has been found in the Gatun Miocene of Costa Rica by Mr. Olsson.

Locality.—Springvale.

Horizon.—Upper Miocene.

***Terebra manzanillæ*, n. sp.**

Pl. 32, Fig. 8

Shell small, very slender and tapering. The single example lies half buried in the matrix. It consists of sixteen whorls, the first two or three nuclear. Subsequent volutions strongly sculptured with sharp-edged, longitudinal ribs, about seven to every half circumference. In the interspaces are very faint, impressed spiral lines. Every whorl is cut at its upper third by an incised groove. The ribs, however, are but slightly, if at all, deflected in direction by this groove. Aperture concealed. Height 16, greatest width 5 mm.

Locality.—Manzanilla.

Horizon.—Lower Miocene.

***Terebra isaacpetiti*, new name**

Terebra Petiti Maury, 1917, Bull. Amer. Paleont., No. 29, p. 31, pl. 4, fig. 4.

Not *Terebra Petiti* Kiener, Coq. viv., p. 37, pl. 13, fig. 2.

The enthusiasm that I felt in dedicating a fine Dominican Miocene *Terebra* to Mr. Isaac Petit, American Consul at Monte Cristi, who proved such a kind and valuable friend

to the Maury Expedition in 1916, caused me to overlook the recent *Terebra petiti* Kiener, named many years prior for the conchologist Petit. Therefore, I now change the name of the Dominican shell to *Terebra isaacpetiti*.

Locality.—Zone A, Rio Gurabo at Los Quemados.

Horizon.—Middle Miocene, Gurabo formation.

Genus *CONUS* Linnæus

Conus stenostoma Sowerby

Pl. 34, Fig. 3

Conus stenostoma Sowerby, 1849, Quart. Jour. Geol. Soc. London, vol. 5, p. 44.

Conus stenostoma Guppy, 1866, *Idem*, vol. 22, p. 287, pl. 16, fig. 2; 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 159; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 38.

Conus stenostoma Gabb, 1873, Trans. Amer. Phil. Soc., vol. 15, p. 230.

Conus catenatus Guppy, 1876, *pro parte*, Quart. Jour. Geol. Soc., vol. 32, p. 527. Not *C. catenatus* Sowerby.

Conus stenostoma Dall, 1903, Trans. Wagner Inst. Sci., vol. 3, p. 1583.

Conus stenostoma Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 454, pp. 4, 6; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, pp. 161, 163.

Conus stenostoma Maury, 1917, Bull. Amer. Paleont., No. 29, p. 39, pl. 6, fig. 4.

Conus stenostoma Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 42, pl. 3, fig. 2.

Shell of medium size, with sharply angulated shoulder, narrow aperture, and deep U-shaped posterior sinus which, as the shell grows, renders the upper surface of the whorls on the spine concavely sulcate. Our largest Trinidad specimen is 52 mm. in height and 28 in width.

Sowerby's type was collected by Colonel Heneken in Santo Domingo where we obtained this species in the Gurabo formation. It is also found at Bowden, Jamaica; and in the Gatun stage of Port Limon, Costa Rica.

Locality.—Springvale.

Horizon.—Upper Miocene.

Conus cf. williamgabbi Maury

Cf. *Conus williamgabbi* Maury, 1916, Bull. Amer. Paleont., No. 29, p. 36, pl. 5, fig. 2.

In the collection is an internal mold of a very large, broad Cone, measuring when entire about 70 mm. in length and 48 in greatest width. It is evidently closely related to, or identical with, the flat-topped, heavy Dominican species, *C. williamgabbi* Maury, but being only a mold no certain identification is possible.

Locality.—Road quarry at 7¾ mile post on Guaico-Tamana Road.

Horizon.—Manzanilla Miocene.

***Conus planiliratus* Sowerby**

Pl. 34, Fig. 6

Conus planiliratus Sowerby, 1849, Quart. Jour. Geol. Soc. London, vol. 5, p. 44.

Conus planiliratus Guppy, 1866, *Idem*, vol. 22, p. 287, pl. 16, fig. 7; 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 159; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 38.

Conus planiliratus Gabb, 1873, *pro parte*, Trans. Amer. Phil. Soc., vol. 15, p. 230.

Conus planiliratus Guppy, 1876, Quart. Jour. Geol. Soc. London, vol. 32, p. 528.

Conus regularis Gabb, 1881, Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 8, p. 359, pl. 46, figs. 45-48. Not *C. regularis* Sowerby.

Conus planiliratus Dall, 1903, Trans. Wagner Inst. Sci., vol. 3, p. 1583.

Conus planiliratus Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, p. 6; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 149.

Conus planiliratus Cossmann, 1913, Jour. de Conchyliologie, vol. 61, p. 48, pl. 3, figs. 25, 26, 27.

Conus planiliratus Maury, 1917, Bull. Amer. Paleont., No. 29, p. 45, pl. 7, fig. 10.

Conus planiliratus Olsson, 1922, *Idem*, No. 39, pl. 3, figs. 10, 13.

A small Cone, high spired, and with the body spirally sulcated. A Trinidad shell is 26 mm. in height, 13 in width.

The recent *C. planiliratus* Sowerby (Proc. Zool. Soc., p. 255, pl. 22, fig. 1) is altogether different from the Miocene fossil that Sowerby described from Santo Domingo, which is also in the Gatun Miocene of Port Limon, Costa Rica, and at Bowden and Mindi.

Locality.—Springvale.

Horizon.—Upper Miocene.

Conus burckhardti Bose

Pl. 34, Fig. 5

Conus Burckhardti Bose, 1906, Bol. Inst. Geol. Mexico, No. 22, p. 50, pl. 5, figs. 39, 40.

Conus Burckhardti Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 52, pl. 3, figs. 4, 5.

In the collection is a slender, high-spired Cone with the body spirally grooved. Whorls about eleven, the two or three nuclear, minute, smooth, the next finely longitudinally ribbed, later volutions smooth except for well-marked, arching growth lines. Grooves on the body much narrower than the bands and finely cross-striated. Bands smooth, flat. Estimated length 20, greatest width 9 mm.

This species was first described from Mexico. Later found in Panama and Costa Rica. Our shell resembles closely Bose's figure 39, from which it differs chiefly in being slightly smaller.

Conus gracilissimus Guppy and *C. tortuosostriatus* Toula are readily distinguished from this species by their spirally striated and delicately coronated spires.

Locality.—13th mile post on Guaico-Tamana road.

Horizon.—Machapoorie Miocene.

Genus TURRIS Bolten**Turris albida** Perry

Pl. 32, Fig. 11

Pleurotoma albida Perry, 1811, Conch. Expl., pl. 32, fig. 4.

Pleurotoma albida Dall, 1890, Trans. Wagner Inst. Sci., vol. 3, p. 28, pl. 4, fig. 8a.

Turris albida Dall, 1915, 90, U. S. Nat. Mus., p. 38, pl. 5, fig. 13, pl. 14, fig. 7.

Turris albida Maury, 1917, Bull. Amer. Paleont., No. 29, p. 50, pl. 8, figs. 4-8; 1922, Bull., 38, p. 32.

Turris albida Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 58, pl. 4, figs. 1, 2.

The many varieties of this species are noted and figured in my Dominican Memoir, in which the long synonymy is also given. Our Trinidad specimens from the Brasso Venada Ravine are like the variety *haitensis* Sowerby. The canals of all are broken, but if complete the shells would

measure about 45 mm. in length and 12 in greatest width. From Manzanilla, we have a very young shell, only 8 mm. long, but it shows the strong, spiral ridges, with interspaces decussated by coarse growth lines, which is a striking feature of this protean species.

Localities.—Manzanilla; Brasso Venada Ravine, 3½ miles east of Brasso Station; Brasso Creek; 11th mile post on Caparo Road.

Horizon.—Manzanilla Miocene.

Turris albida var. *sancti-davidis*, n. var.

Pl. 32, Figs. 6, 7

In the collection are specimens resembling *Turris albida* Perry, but instead of the intervals between the spirals being obliquely cross-striated, they bear exceedingly fine and delicate spiral striæ. The first two volutions are smooth, nuclear. The following three or four are markedly tuberculate. Spiral sculpture sharp and strong. Whorls centrally bicarinated. Height 22, greatest width 9 mm.

Locality.—Manzanilla.

Horizon.—Lower Miocene.

Genus *DRILLIA* Gray

Drillia henekeni Sowerby

Pl. 32, Fig. 13

Pleurotoma Henikeri Sowerby, 1849, Quart. Jour. Geol. Soc. London, vol. 5, p. 50, pl. 10, fig. 6.

Turris (Surcula) Henekeni Gabb, 1873, Trans. Amer. Phil. Soc., vol. 15, p. 207.

Pleurotoma henekeni Guppy, 1876, Quart. Jour. Geol. Soc., vol. 32, p. 526.

Not *Drillia henekeni* Cossmann, 1913, Journ. de Conchyliologie, vol. 61, pl. 3, figs. 10, 11.

Drillia Henekeni Maury, 1917, Bull. Amer. Paleont., No. 29, p. 53, pl. 8, figs. 17, 18.

In the Trinidad collection is a specimen which, on comparison, agrees in every respect with Dominican examples of *Drillia henekeni* Sowerby. It is broken at the base, but if complete would measure about 58 mm. in length and 17 in greatest width.

D. henekeni is present in the Bowden beds, Jamaica, as well as in both the Gurabo and Cercado formations, Dominican Republic.

Locality.—11th mile post on Caparo Road.

Horizon.—Manzanilla Miocene.

Drillia henekeni var. *caroniana*, n. var.

Pl. 32, Fig. 12

Shell resembling the Dominican Miocene *Drillia henekeni* Sowerby, in general aspect, but differing in the character of the ribbing. Specimens of *henekeni* have seven or eight rounded, coarse and prominent longitudinal ribs on each of the last two whorls, but this Trinidad form has eleven or twelve. Thus the costæ are more numerous, and they are also lower and less pronounced and more regular than in the typical shells. One specimen has the ribbing obsolescent on the body whorl. Estimated length of complete shell 57, greatest width 16 mm.

Locality.—Springvale.

Horizon.—Upper Miocene.

Drillia belahubbardi, new name

Drillia grabau Hubbard, 1921, New York Acad. Sci., Sci. Surv. Porto Rico and the Virgin Islands, vol. 3, pt. 2, p. 158, pl. 24, fig. 10.
Not *Drillia grabau* Maury, 1910, Bull. Amer. Paleont., No. 21, p. 8, pl. 2, fig. 3.

Since I had named a *Drillia* from the Chipola Miocene, at Bailey's Ferry, Florida, in honor of Professor Grabau, eleven years earlier, Mr. Hubbard's *Drillia grabau* from the Quebradillas limestone, Porto Rico, requires a new name. It seems appropriate to dedicate the Porto Rican species to Mr. Bela Hubbard, himself.

Locality.—Quebradillas, northern Porto Rico.

Horizon.—Quebradillas Miocene, which is Upper Lower, or Middle Miocene.

Drillia consors Sowerby

Pl. 32, Fig. 10

- Pleurotoma consors* Sowerby, 1849, Quart. Jour. Geol. Soc. London, vol. 5, p. 50.
Pleurotoma consors Guppy, 1866, Quart. Jour., vol. 22, p. 280; 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 159; Harris Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 38; 1876, Quart. Jour. Geol. Soc., vol. 32, p. 527.
Drillia consors Maury, 1917, Bull. Amer. Paleont., No. 29, p. 53, pl. 8, figs. 15, 16.
Drillia consors Jones, 1918, Jour. Geol., vol. 26, p. 741.
Drillia consors Vaughan, 1919, Bull. 103, U. S. Nat. Mus., p. 561.
Drillia consors Maury, 1920, Sci. Surv. Porto Rico and the Virgin Islands (New York Acad. Sci.), vol. 3, pt. 1, p. 71.
Drillia consors Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 62, pl. 4, figs. 8, 10, 13.

More complete synonymy is given in my Dominican Memoir; and as there noted, the recent related form is the deep water *Drillia alsidota* var. *macilenta* Dall.

Although *D. consors* has been found in Miocene beds of Jamaica, Panama and Martinique, as well as the type locality, Dominican Republic, this is the first time it has been reported from Trinidad. Our specimens are more closely and finely ribbed than the typical, and resemble mutations from further south.

Localities.—Half a mile above Brasso Station; Brasso Venada Ravine; 3 miles east of Brasso Station; 13th mile post on Guaico-Tamana Road.

Horizons.—Brasso, Manzanilla, and Machapoorie Miocene.

Drillia manzanillica, n. sp.

Pl. 32, Fig. 4

Shell of moderate size, markedly fusiform, with a long and slender anterior canal, resembling that of *Drillia fusiformis* Gabb, but very different from that species in sculpture. Whorls ten or eleven, the first two smooth, nuclear. Later volutions at first nearly flat but becoming progressively more convex, so that the body whorl above the canal is very round. But the posterior sinus is deeply U-shaped, and with the growth of the shell leaves a conspicuous, concave zone, especially on the last two whorls, just beneath

the suture. The longitudinal sculpture is of narrow, sharp ribs which arch backwards over the concave zone but over the rest of the whorl are nearly vertical. On the last volution the ribs number about sixteen. The spiral sculpture is of revolving threads which are most apparent in the interspaces but on the body area cross lightly over the ribs. The subsutural zone is also spirally striate and the ribs there are somewhat lower and weaker. Length of largest shell 23, greatest width 8 mm.

In the general type of spire sculpture this species resembles *D. callistopleura* Pilsbry and Johnson, but differs markedly in the excavated subsutural zone and in the form of the body and canal.

Localities.—Manzanilla Nos. 263, 264; also Brasso Creek.

Horizon.—Manzanilla Miocene.

Drillia vaningeni var. *sancti-andreae*, n. var. Pl. 32, Figs. 1, 14

Shell resembling in form and type of sculpture *D. vaningeni* [*Pleurotoma* (*Gemmula*) *vaningeni* Brown and Pilsbry, Proc. Acad. Nat. Sci. Phila., p. 505, pl. 22, fig. 4, 1912] from the Miocene of the Gatun Locks, but differing in the following respects: In this Trinidad shell the raised, nodose band between the two sulci is not so prominent; the nodulations are finer, closer, and more numerous; and the spirals in the sulci appear stronger than in the Gatun type. All our specimens are incomplete but when perfect the largest would be about 33 mm. in height and 12 in greatest width. Above the nodules the growth lines swing backward and below them they swing forward, showing that the notch was on the shoulder as in *Drillia*.

Localities.—11th mile post on Caparo Road (two shells); Manzanilla (fragments of two spires).

Horizon.—Manzanilla Miocene.

Drillia vaningeni var. *machapoorensis*, n. var. Pl. 32, Figs. 5, 9

In the collection are a number of specimens with the *vaningeni* type of sculpture, but much smaller and more delicate than the variety *sancti-andreae*. When complete the largest would measure about 19 x 6.5 mm. Those are about the dimensions of the Gatun type of *vaningeni* but that shell is very much more boldly ornamented.

In this Trinidad variety, at the base of every whorl is a spiral, above which is a duplex, beaded zone, followed by a $\wedge$ -shaped carina with spiral striae on either slope. The carina is nearly as prominent as the beaded zone, while in the type of *vaningeni* the tuberculate ridge is very much the stronger.

Locality.—13th mile post on Guaico-Tamana Road.

Horizon.—Machapoorie Miocene.

Genus *BORSONIA* Bellardi

Borsonia varicosa Sowerby

Pl. 34, Fig. 7

Mitra varicosa Sowerby, 1849, Quart. Jour. Geol. Soc., vol. 5, p. 46. (Heneken's shell).

Cordiera varicosa Gabb, 1873, Trans. Amer. Philos. Soc., vol. 15, p. 210.

Borsonia varicosa Maury, 1917, Bull. Amer. Paleont., No. 29, p. 51, pl. 8, fig. 9 (Gabb's shell).

Borsonia (*Paraborsonia*) *varicosa* Pilsbry, 1922, Proc. Acad. Nat. Sci. Phila., vol. 73, p. 325, pl. 17, figs. 19, 20, 21 (Gabb's shell).

We have two rather worn shells which show the bipliate columella, and characteristic notch of *Borsonia*, and the sculpture is like that of the Dominican Miocene species, *B. varicosa* Sowerby. Our most complete shell is 19 mm. in height and 7 in greatest width.

This is the first time that this genus has been found in Trinidad. The type locality of *varicosa* is the Dominican Republic. Recent species are in the abyssal zone of the Antilles.

Locality.—Brasso Venada Ravine, 3 miles east of Brasso Station, in west central Trinidad.

Horizon.—Manzanilla Miocene.

Genus *SCOBINELLA* Conrad

Scobinella morierei (Laville) Cossmann Pl. 34, Figs. 1, 8

Euchilodon Morierei (Laville, MS.) Cossmann, 1913, Journ. de Conchyliologie, vol. 61, p. 34, pl. 3, figs. 6, 7.

Scobinella Morierei Olsson, 1922, Bull. Amer. Paleont., No. 29, p. 79, pl. 4, figs. 3, 4.

We have from Trinidad a single imperfect specimen of this interesting shell. Although incomplete, it shows the characteristic beaded sculpture and the four strong folds on the columella. Figured with our Trinidad shell is a copy of Cossmann's type from the Gatun of Mindi, Canal Zone. The type was 42 by 11 mm.

This species was referred by Monsieur Cossmann to *Euchilodon*; but, as that genus has more numerous columellar plaits (in some species as many as twelve) it is better placed in Conrad's *Scobinella*.

In the Dominican Miocene are *S. magnifica* Gabb, a more slender, elongated and elegant species, and *tristis* Pilsbry and Johnson, which has more the form of *morierei*, but has the spire less boldly and handsomely sculptured.

Locality.—Brasso Venada Ravine, 3 miles east of Brasso Station.

Horizon.—Manzanilla Miocene.

Genus *CANCELLARIA* Lamarck

Cancellaria epistomifera Guppy Pl. 35, Fig 7

Cancellaria Moorei Gabb, 1873, Trans. Amer. Phil. Soc., vol. 15, p. 236. Not *C. Moorei* Guppy, 1866.

Cancellaria epistomifera Guppy, 1876, Quart. Jour. Geol. Soc. London, vol. 32, p. 520, pl. 28, fig. 29.

Cancellaria epistomifera Cossmann, 1913, Journ. de Conchyliologie, vol. 61, pp. 53, 54, pl. 4, figs. 5, 6.

Cancellaria epistomifera Maury, 1917, Bull. Amer. Paleont., No. 29, p. 63, pl. 10, figs. 3, 4, 5.

Cancellaria epistomifera Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 83.

We have in the collection a single young, and somewhat

crushed, specimen of a *Cancellaria* which corresponds to young shells of similar size of *C. epistomifera* Guppy, from Santo Domingo. The form, cancellation, position of the varix and columellar plaits agree and the shell seems identical with this species. The shell measures 30 mm. in height, 18 in width. Large Dominican specimens are 38 x 25 mm., and have on the outer lip towards the base the characteristic little spout. *C. epistomifera* is found not only in the Dominican Republic which is the type locality ("Haiti" of Guppy), but also on Martinique and at Gatun.

Locality.—Springvale.

Horizon.—Upper Miocene.

Cancellaria montserratensis, n. sp.

Pl. 35, figs. 6, 8

Shell rather small with seven or eight whorls, spire acute and relatively slender for the size of the last volution. The whorls are sharply angulated and shouldered beneath the suture; and are cancellated by the intersection of spiral, strap-like, bands and longitudinal ribs. On the last whorl there are about ten prominent spirals with two weaker ones on the flattened area beneath the suture and three close, fine threads at the base of the shell. The penultimate whorl has four spirals. The ribs on the body number about twelve and their points of intersection with the spirals are slightly tuberculate, especially those on the spiral which edges the shoulder carina. Columella triplicate, the basal fold bordering the anterior canal. Outer lip lirate within. Length of shell 28, greatest width 16 mm.

In general shape this is somewhat like *C. harrisi* Maury from the Dominican Miocene, but instead of the very fine and elegant ornamentation of that species, this shell is coarsely sculptured. In the shouldering of the whorls it resembles *C. conradiana* Dall.

Locality.—Springvale. The quarry is in a spur of the Montserrat range.

Horizon.—Upper Miocene.

Genus *OLIVA* Bruguière*Oliva cylindrica* Sowerby

Pl. 33, Figs. 3, 5

Oliva cylindrica Sowerby, 1849, Quart. Jour. Geol. Soc. London, vol. 5, p. 45.

Oliva reticularis Guppy, 1866, *Idem*, vol. 22, p. 288. Not *O. reticularis* Lamarek.

Oliva cylindrica Gabb, 1873, Trans. Amer. Phil. Soc., vol. 15, p. 215.

Oliva cylindrica Guppy, 1876, Quart. Jour. Geol. Soc., vol. 32, p. 526.

Oliva cylindrica Dall, 1903, Trans. Wagner Inst. Sci., vol. 3, p. 1583.

Oliva cylindrica Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper 440, p. 6; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 149.

Oliva cylindrica Maury, 1917, Bull. Amer. Paleont., No. 29, p. 67, pl. 10, figs. 14, 14a.

In the collection are a large number of Olives which correspond to medium-sized specimens of *O. cylindrica* Sowerby, from the Dominican Miocene. The average size of the Trinidad specimens is about 46 mm. in height, 20 in width, and length of aperture 40 mm. The shell is broader and the spire lower than in an adolescent shell of equal size of the associated species, *Oliva couvana*.

Locality.—Springvale.

Horizon.—Upper Miocene.

Oliva couvana, n. sp.

Pl. 33, Fig. 6

Shell very large, moderately slender, with a rather high, very acute spire. Whorls eight, the first two and a half, nuclear, smooth and glassy. Subsequent whorls porcellaneous with very narrowly channelled sutures. Columella with the callus quite thick at the base, thinning out above, plaits three, striations about twenty-two, all nearly equal in strength except the two most anterior. Height of largest shell 80, greatest width 31, length of aperture 65 mm.

This very fine shell is nearest to *Oliva proavia* Pilsbry and Johnson of Gabb's Dominican collection; but in the Trinidad species the body is broader, the spire shorter, the aperture is longer—coming up higher on the body—and the

columellar striæ are subequal. The type of *proavia* measured 81.5 x 27, aperture 65, showing the above-described differences in proportion.

Adolescent specimens of 45 or 55 mm. resemble in size adult shells of *Oliva cylindrica* Sowerby from Santo Domingo; but the Trinidad shells are slenderer and more tapering at the shoulder.

Locality.—Springvale.

Horizon.—Upper Miocene.

***Oliva trinidadensis* Maury**

Oliva trinidadensis Maury, 1912, Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 15, p. 67, pl. 10, fig. 4.

A small, broad shouldered species tapering towards the base. Height 15, greatest width 8 mm.

Locality.—Southern main road south of Pitch Lake, Brighton.

Horizon.—Upper Miocene.

***Oliva cercadia*, n. sp.**

Oliva brevispira Maury, 1917, Bull. Amer. Paleont., No. 29, p. 68, pl. 10, figs. 16 (Gabb coll.), 17 (Maury coll.).

Oliva brevispira Gabb, in coll., but not Gabb's type of *brevispira*.

My Dominican specimens that I called *O. brevispira* agreed with a specimen in the Cornell Museum collected by Professor Gabb and labelled by him *brevispira*. But they are not like his type of *O. brevispira* lately figured by Dr. Pilsbry. This is, however, not surprising because Gabb often had several distinct species in one box all labelled the same.

As this shell was very abundant at Cercado, the name *cercadia* seems appropriate.

Localities.—Bluffs 2 and 3, Cercado de Mao; Zone G, Rio Gurabo at Los Quemados; Zones H and I, Rio Cana at Caimito, Dominican Republic.

Horizon.—Lower Miocene, Cercado formation.

Genus *OLIVELLA* Swainson*Olivella mutica* Say

Pl. 33, Fig. 2

Olivella mutica Say, 1822, Jour. Acad. Nat. Sci. Phila., vol. 2, p. 228.*Olivella mutica* Holmes, 1860, Post-Pl. Fos. S. Car., p. 76, pl. 12, fig. 8.*Olivella mutica* Tryon, 1883, Man. Conch., vol. 5, p. 64, pl. 14, figs. 43-55.*Olivella mutica* Dall, 1889, Bull. U. S. Nat. Mus., No. 37, p. 106, pl. 34, figs. 1, 2.*Olivella mutica* Dall, 1898, *pro parte*, Trans. Wagner Inst. Sci., vol. 3, p. 45.*Olivella mutica* Maury, 1922, Bull. Amer. Paleont., No. 38, p. 46.

Olivellas are in the collection which resemble small specimens of *O. mutica* Say.

Gabb's *Olivella muticoides* is much plumper, while Guppy's *indivisa* has a very high, slender spire.

O. mutica is present in beds of Miocene age in Florida and the Dominican Republic. It is now living among the Antilles, Trinidad being its most southern limit.

Localities.—Springvale; Matura; also shores of Trinidad.

Horizons.—Upper Miocene; Pliocene; and Recent.

Genus *ANCILLA* Lamarck*Ancilla lamellata* Guppy

Pl. 33, Figs. 7, 11

Ancillaria lamellata Guppy, 1866, Quart. Jour. Geol. Soc. London, vol. 22, p. 579, pl. 26, fig. 9.*Ancillaria lamellata* Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 159; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 186.*Ancillaria lamellata* Guppy, 1874, Geol. Mag., London, p. 439.Not *Ancillaria lamellata* Guppy, 1910.

Shell rather small, ovately conic, with a short, acute spire and moderately inflated body. Whorls five, the first smooth, embryonic, minute. All the subsequent whorls of the spire and the upper half of the body whorl are coated with enamel which is finely and regularly spirally striated. Sometimes these striations extend down to the lower limit of the enamel on the body, or sometimes the lower portion of the enamel is smooth. The enamel descends into the inner lip. The columella posteriorly bears a curious plate-like

process, not a fold, but a single lamella. For this the specific name was given. Length of our largest specimen 30, maximum width 14 mm.

Dr. Guppy's type was from Manzanilla. We also have specimens from there; but our finest are from the central part of the island.

Localities.—Manzanilla; also the NE. $\frac{1}{4}$ E. 24, No. 394; and Brasso Creek.

Horizon.—Manzanilla Miocene.

Ancilla caroniana, n. sp.

Pl. 33, Figs. 4, 10, 12

Ancillaria lamellata Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, p. 10; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 153.

Ancillaria lamellata Guppy, Agr. Soc. Trinidad and Tobago, Paper No. 454, p. 9; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 165.

Not *Ancillaria lamellata* Guppy, 1866.

Shell very much larger and more ventricose than the Manzanillan species, *Ancilla lamellata* Guppy. The body whorl is very large and inflated, the spire extremely acute. Each whorl has just above the suture a low, but sharp, carina. There are no spirals whatever upon the spire, nor upon the body whorl except just at the base, which bears a pair of deeply incised lines, followed by a more distant third line, and this by two basal grooves. The entire spire and the upper third of the body whorl are covered with a polished enamel coating which terminates very neatly and abruptly, bounding the upper third of the last volution, except at the aperture, which it descends along a sharp, oblique line, 6 or 7 mm. beyond the aperture, then swings forward, thickens, and form a hollow loop in the upper part of the aperture, then descends and becomes applied to the lower part of the pillar. Length of largest specimen 60, greatest width 27 mm.

This is distinguished at once from *A. lamellata* by its large size and the entire absence of spirals on the spire and upper part of the body.

The type of the Jamaican *Ancilla pinguis* Guppy (Geol. Mag., London, p. 434, pl. 16, fig. 3, 1874) is a small form, about 21 x 9 mm. The figure is poor and the description brief; but it is unlike this fine, large species.

Ancilla shepardi Dall from the Oligocene of Tampa, Florida, is somewhat like this Trinidad shell in general form, but entirely different in the characters of the aperture. It has not the great loop of callus extending into the aperture from the pillar.

Localities.—Springvale (large and fine), types; 11th mile post on Caparo Road small, but apparently this species.

Horizons.—Springvale Miocene and Manzanilla Miocene.

Ancilla brassica, n. sp.

Pl. 33, Figs. 1, 8, 9

Shell ovate-conic, inflated, short and broad. Whorls about six, the penultimate more or less concavely excavated. Spire entirely smooth and covered with enamel. A young shell shows the callus extending almost to the base of the body whorl. Older specimens are entirely callused over, even to the very base of the pillar. Estimated length of largest shell when entire 30, greatest width 16 mm.

This is even plumper than the Jamaican *A. pinguis* Guppy, and in that species the callus ends above the center of the last whorl.

Localities.—Brasso district; half a mile above Brasso Station; 13th mile post on Guaico-Tamana Road.

Horizons.—Brasso and Machapoorie Miocene.

Genus *MARGINELLA* Lamarck

Marginella calypsonis, n. sp.

Pl. 34, Figs. 12, 13

Shell rather small, solid, polished, with about four whorls. Spire acute, rising about 4 mm. above the summit of the outer lip, coated with callus in front, but at the back showing the sutures. Callus very heavy on both inner and outer lips, producing almost a *Cypræa*-like effect. Outer

lip smooth within, with the thick edging of callus reflected and grooved externally. The callosity on the inner lip is slightly flattened, extends upon the spire and is continuous with that of the outer lip. Pillar with four plaits, about equidistant, the basal bordering the anterior canal. Length of shell 21, greatest width 11 mm.

This species is nearest akin to the larger, Costa Rican, Gatun Miocene species, *M. macdonaldi* Dall, and perhaps should be considered a variety of that form.

Locality.—Springvale.

Horizon.—Upper Miocene.

***Marginella springvalensis*, n. sp.**

Pl. 34, Figs. 10, 14

Shell moderately large, very solid, polished, five-whorled. Spire short, rather acute, more or less washed over with callus which, however, usually does not entirely obliterate the sutures. Outer lip very thick, smooth within, rolled back, and grooved externally. Aperture narrow posteriorly, widening anteriorly. Pillar with five, strong plaits, the upper nearly horizontal, the lower bordering the anterior canal. Length 43, greatest width 25 mm.

In general form this resembles *M. aurora* Dall, from the Chipolan Miocene of Florida; but the Trinidad shell is nearly twice as large, and the outer lip is smooth within, instead of finely denticulate.

Locality.—Springvale.

Horizon.—Upper Miocene.

***Marginella guaica*, n. sp.**

Pl. 34, Figs. 2, 4

Shell high-spired, with about five whorls. The earlier whorls are smooth. On the later volutions an incised spiral develops beneath the suture, and on the shoulder region longitudinal plications appear. These become progressively stronger so as to be a striking feature of the shell, especially on the upper part of the back of the body whorl. Outer lip sharply denticulate below the region of the posterior canal. Inner lip with three strong, medially grooved

folds, and a fourth borders the anterior canal. Height 11.5, greatest width 6.5 mm.

In form and in the grooving of the columellar plicæ this resembles the much larger Dominican shell, *M. sowerbyi* Gabb, but that lacks the longitudinal riblets.

Locality.—13th mile post on Guaico-Tamana Road.

Horizon.—Machapoorie Miocene.

***Marginella dalliana* Maury**

Marginella dalliana Maury, 1912, Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 15, p. 67, pl. 10, figs. 5, 6.

Somewhat like *M. ballista* Dall and *coniformis* Guppy. Height 20, greatest width 13, length of aperture 18 mm.

Locality.—Brighton, 1000 feet west of the pier, in impure asphalt.

Horizon.—Pliocene.

***Marginella solitaria* Guppy**

Marginella solitaria Guppy, 1896, Proc. U. S. Nat. Mus., vol. 19, p. 308, pl. 29, fig. 14.

Locality.—*Cadulus* bed, Pointe-à-Pierre (Guppy).

Horizon.—Miocene.

Subgenus *VOLUTELLA* Swainson

***Marginella (Volutella) maiaë*, n. sp.**

Pl. 34, Fig. 9

Shell very large, nearly equalling in size the recent *M. bullata* Born, from Bahia, Brazil, which is the giant of the genus, attaining 2½ to 3½ inches in length. This Trinidad fossil is, however, of different form. *M. bullata* is very tapering towards the base, while this shell, although broken anteriorly, shows that its form was much more cylindrical, and at the lower third would be proportionately wider than *bullata*. Our shell consists of about four volutions, but the spire is so very flat that the upper margin of the outer lip rises several millimetres above it. The inner lip shows no callus, but the outer has a very heavy

thickening which is rolled back and furrowed. Pillar with four plaits, the uppermost short, nearly horizontal, the remainder very oblique. Estimated complete length 57, greatest width 35 mm.

Locality.—Springvale.

Horizon.—Upper Miocene.

Subgenus *PERSICULA* Schumacher

***Marginella (Persicula) couviana*, n. sp.**

Pl. 34, Fig 11

Shell small, with the spire depressed and coated with enamel so that the volutions are concealed. Outer lip slightly thickened, smooth within, not grooved externally. Inner lip with five plications, the two lower very much stronger and longer than the three upper. The largest specimen shows faint traces on the body whorl of a color pattern of fine, revolving, brownish lines. Height 10, greatest width 7 mm. The two small shells are about 8 x 5 mm.

The Dominican Miocene *Persicula cercadensis* Maury, differs in having the outer lip faintly crenate within, and bears eight plications on the inner lip.

Locality.—Springvale.

Horizon.—Upper Miocene.

***Marginella (Persicula) arcuata* Guppy**

Marginella (Persicula) arcuata Guppy, 1896, Proc. U. S. Nat. Mus., vol. 19, p. 308, pl. 19, fig. 13.

Locality.—Cadulus bed, Pointe-à-Pierre (Guppy).

Horizon.—Miocene.

Genus *MITRA* Lamarck

***Mitra henekeni* Sowerby**

Pl. 35, Fig. 2

Mitra Henekeri Sowerby, 1849, Quart. Jour. Geol. Soc. London, vol. 5, p. 46, pl. 9, fig. 5.

Mitra Henekeni Gabb, 1873, Trans. Amer. Philos. Soc., vol. 15, p. 219.

Mitra Henekeni Guppy, 1876, *pro parte*, Quart. Jour. Geol. Soc. London, vol. 32, p. 528.

Mitra Henekeni Maury, 1917, Bull. Amer. Paleont., No. 29, p. 74, pl. 12, figs. 5, 5a.

Mitra Henekeni Jones, 1918, Jour. Geol., vol. 26, p. 741.

Mitra Henekeni Maury, 1920, Sci. Surv. Porto Rico and the Virgin Isls., vol. 3, pt. 1, p. 65.

Mitra Henekeni Hubbard, 1921, Porto Rico and the Virgin Isls., vol. 3, pt. 2, p. 155, pl. 24, fig. 1.

In the collection is a single very young shell which agrees perfectly in form and sculpture with young Dominican specimens of *Mitra henekeni* Sowerby. The Trinidad shell is broken at the base but when entire would be about 19 or 20 mm. in length. Fine adult specimens from the Gurabo and Cercado formations measure 56 x 15.5 mm. It also occurs at Bowden, Jamaica.

Locality.—Manzanilla.

Horizon.—Manzanilla Miocene.

Mitra longa Gabb

Mitra longa Gabb, 1873, Trans. Amer. Phil. Soc., vol. 15, p. 219, Pilsbry's fig. of type, 1922, Proc. Acad. Nat. Sci. Phila., vol. 73, pl. 24, fig. 3.

Mitra longa Maury, 1917, Bull. Amer. Paleont., No. 29, p. 74, pl. 11, figs. 11, 11a.

Mitra longa Olsson, 1922, Bull. No. 39, p. 101, pl. 6, fig. 10.

We have a worn specimen which resembles in form adolescent shells of *M. longa* Gabb, and measures 35 x 10 mm. It is probably this species but, apparently because of its decorticated condition, all the major spirals appear to be double-edged. Possibly this is natural, but it seems more likely a deceptive effect, such as one often sees on worn shells of *Arca* where single ribs seem medially grooved.

Locality.—Manzanilla.

Horizon.—Manzanilla Miocene.

Mitra longa Gabb var. *couvensis*, n. var.

Pl. 35, Figs. 1, 4

Mitra Henekeni Guppy, 1910, Springvale Fossils. Agr. Soc. Trin. and Tobago, Paper No. 440, p. 8; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 151.

Not *Mitra Henekeni* Sowerby, 1849, Quart. Jour. Geol. Soc. London,

vol. 5, p. 46, pl. 9, fig. 5.

Shell very closely related to *Mitra longa* Gabb (Trans. Amer. Phil. Soc., vol. 15, p. 219, 1873) but differing in its contours, the body whorl being more convex and the spire more acutely tapering. This is probably why Dr. Guppy referred the species to *M. henekeni* Sowerby, which it somewhat approaches in form; but a comparison with specimens of *henekeni* from the type locality, shows that the Springvale shell is certainly not that species. The more elongated, more cylindrical body whorl of the Springvale shell, and the very pretty sculpturing of two or three fine spiral threads crossed by vertical growth lines in the intervals between the strong revolving cords, indicate its kinship with *M. longa*. But the body whorl is more shouldered and bevelled just beneath the suture and its greater convexity is shown by the following measurements. The body whorl of a meta-type of Gabb's *longa* measures 43 mm. in length and 13 in greatest width, while that of a Springvale shell is 43 x 15 mm. The last whorl of our largest shell measures 48 x 18. A nearly perfect medium-sized specimen has a total length of 50 and width of 15 mm.

We have typical *M. longa* from Cercado de Mao and Caimito, Dominican Republic; and it is reported from Gatun beds of the Canal Zone and from Cartagena, Colombia.

Locality.—Springvale, near Couva.

Horizon.—Upper Miocene.

***Mitra sancti-francisci*, n. sp.**

Pl. 35, Fig. 13

Shell attaining a large size when adult, coarsely and crudely sculptured, excavated or bevelled beneath the suture, and the body whorl with a central constricted or flattened region; columellar plications about three, the third feeble. Sculpture of sharp-edged, subequal, spiral ridges of which there are sixteen on the body whorl and five on the two preceding volutions. Interspaces slightly concave, marked only with longitudinal growth striæ.

Approximate length of large shell when perfect 65, greatest width 20 mm.

In general form this species bears a resemblance to the living west coast *Mitra swainsoni* Broderip, and to its Gatun Miocene variety *limonensis* Olsson. The living shell is nearly smooth. Mr. Olsson's shell in sculpture is more like the Trinidad, but has six spirals on the two whorls before the last, the suture is not excavated, and the constriction not nearly so marked. On comparing the type of *limonensis* it is seen not to be identical with this shell, but appears to be its nearest ally.

Locality.—Springvale.

Horizon.—Upper Miocene.

Genus *TURRICULA* (Klein) Adams

Turricula bristoli, n. sp.

Pl. 35, Fig. 5

Shell small, fusiform, whorls convex, sculptured with narrow, longitudinal ribs, and incised spirals in the interspaces. On the body whorl there are fifteen ribs. Outer lip with eight liræ within. Columella with four plications. Height 12, greatest width 5 mm.

In general form this resembles *T. tortuosa* Gabb, in miniature, but the spire is relatively even more convex. In the narrow ribbing it is like *T. tortuosella* Pilsbry and Johnson, but the spire of that species is much slenderer even than that of *tortuosa*, and very much more so than in our species.

This pretty shell is named in honor of Professor George P. Bristol, head of the Greek Department, Cornell University, as a token of appreciation of his interest in this Memoir.

Locality.—Brasso Junction quarry.

Horizon.—Brasso Miocene.

Genus *FUSUS* Lamarck**Fusus springvalensis**, n. sp.

Pl. 35, Fig. 11

Fusus haitensis Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 454, p. 4 (Springvale fossils); Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 161.

Not *Fusus Haitensis* Sowerby, 1849, Quart. Jour. Geol. Soc. London, vol. 5, p. 49.

Not *Fusus Haitensis* Guppy, 1876, Quart. Jour. Geol. Soc., vol. 32, p. 524, pl. 28, fig. 2.

In the Trinidad material is a large *Fusus* about the size of the handsome *Fusus henekeni-haitensis-veatchi* group of the Dominican Miocene.

Probably the shell is similar to that Dr. Guppy collected at the same place and referred to *F. haitensis* Sowerby, but it is not that species.

Our species is nearest to *F. veatchi* Maury, which it resembles in the absence of longitudinal ribs on the last two whorls; but in the Trinidad shell this gerontic character is carried much further, and even the third volution from the last is almost smooth; but shows faint traces of about twelve obsolete ribs. On the corresponding volution of *veatchi* there are eight or nine strong costæ. The spire of the Trinidad shell also tapers much less rapidly and the canal is not so slender. It was evidently a much stouter, more robust shell. The entire surface is sculptured with coarse spiral ridges, often alternating with weaker threads. The incomplete shell measures 63 mm. in length, and 22 in greatest width.

Locality.—Springvale.

Horizon.—Upper Miocene.

Genus *FASCIOLARIA* Lamarck**Fasciolaria**, sp. indet.

In the collection are three fragments of the internal molds of a large *Fasciolaria*. The condition of preservation does not permit a description, but there are inequalities

on the shoulder of the body which suggest that the surface may have been tuberculate. Our largest mold, of the two last whorls with the pillar broken off, is 110 mm. long and 65 wide.

This may be the same species that Dr. Guppy collected at Springvale and said it exceeded eight inches in length. He referred it, but erroneously, to *Fasciolaria semistrata* Sowerby. But that shell never attains any such size—my largest from Santo Domingo, the type locality, are 95 x 40 mm., and this Trinidad species when entire seems to have reached a length of 200 mm.

Locality.—Springvale.

Horizon.—Upper Miocene.

Genus *XANCUS* Bolten

Xancus prævoideus Maury

Pl. 38, Fig. 1

Turbinella ovoidea Gabb, 1873, Trans. Amer. Phil. Soc., vol. 15, p. 218.
Not *Turbinella ovoidea* Kiener, Reeve Icon., fig. 23.

Turbinellus ovoideus Guppy, *pro parte*, 1874, Geol. Mag., London, p. 438; 1876, Quart. Jour. Geol. Soc. London, vol. 32, p. 523.

Turbinella ovoidea Tryon, *pro parte*, 1882, Man. Conch., vol. 4, p. 70.
Not the recent shell.

Turbinellus ovoideus Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, p. 6; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 85, p. 149.

Xancus prævoideus Maury, 1917, Bull. Amer. Paleont., No. 29, p. 83, pl. 14, fig. 18.

Xancus prævoideus Pilsbry, 1922, Proc. Acad. Nat. Sci. Phila., vol. 73, p. 343.

This species differs from the recent *X. ovoideus* Kiener, in having the early whorls tuberculately costate as well as spirally striate, the spirals persisting for one or two whorls beyond the termination of the costæ. In *ovoides* the spire has the early whorls striated only, not tuberculate.

In the Trinidad collection are some large and heavy shells of *Xancus* resembling the types of *prævoideus*, except that the last whorl of the Trinidad shell is even more ventricose; but the characters of the spire and general aspect otherwise correspond. The best specimen equals in

length the largest Dominican shells, and measures 200 mm. in length and 60 in greatest width.

Locality.—Springvale.

Horizon.—Upper Miocene.

Xancus trinitatis, n. sp.

Pl. 39, Fig. 1

Shell exceedingly large and heavy, differing in contour from *præovoideus*, the shape being more fusiform, the body proportionately longer and less wide and all the volutions less convex. The very early whorls are lacking, but below the last striated volution the first whorls are slightly but clearly carinate below the suture. All the shells are incomplete, but the largest is 255 mm. long and when entire would measure 300 x 100 mm.

Locality.—Springvale.

Horizon.—Upper Miocene.

Genus *MELONGENA* Schumacher

Melongena consors Sowerby

Pl. 35, Fig. 12

Pyrula consors Sowerby, 1849, Quart. Jour. Geol. Soc. London, vol. 5, p. 49.

Melongena melongena Gabb, 1873, *pro parte*, Trans. Amer. Phil. Soc., vol. 15, p. 205. Not *M. melongena* Linnæus; nor *M. patula* Brod. and Sby.

Pyrula melongena Guppy, 1874, *pro parte*, Geol. Mag., London, p. 438; 1876, Quart. Jour. Geol. Soc., vol. 32, p. 523.

Melongena consors Dall, 1903, Trans. Wagner Inst. Sci., vol. 3, p. 1584.

Melongena consors Maury, 1917, Bull. Amer. Paleont., No. 29, p. 85, pl. 14, fig. 5.

Melongena consors Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 112, pl. 9, fig. 1.

Shell when well grown very large and heavy, an aged Dominican specimen being 120 mm. in height and 60 in greatest width. The early whorls are unarmed, but the later volutions develope stout spines, of which there are usually two or three rows on the shoulder and one row towards the base; but the spines form a somewhat variable feature.

From Springvale we have the incomplete spire and shoulder of a *Melongena*, very badly preserved, but seemingly a fragment of a large example of *M. consors*.

There are also two smaller specimens 50 x 33 and 52 x 34 mm. both partially concealed but probably young shells of this species; and also a very worn and abraded, somewhat larger specimen.

The recent *M. melongena* is no doubt a descendant of *consors*. The chief points of difference are that *consors* is heavier, has a higher spire, and the body whorl is coarsely spirally striate.

The type locality is Santo Domingo, where we collected it in the Cercado formation. It is also found at Bowden, Jamaica, and in the Gatun stage of Costa Rica.

Localities.—Springvale; Manzanilla; Brasso Creek; Junction Mayo and Couva Roads.

Horizons.—Springvale Miocene; Brasso Miocene; Manzanilla Miocene.

Genus *SOLENOSTEIRA* Dall

Solenosteira semiglobosa Guppy

Pl. 36, Fig. 1

Solenosteira semiglobosa Guppy, 1910, Agr. Soc. Trinidad and Tobago, vol. 11, Paper No. 454, p. 7, pl. 2, figs. 5, 6; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 163, pl. 8, figs. 5, 6.

Shell pyriform, subglobose, seven-whorled. Sculpture of strong, even, spiral grooves, alternating with sharply defined ridges. Both grooves and ridges bear fine, spiral threads, crossed by fainter longitudinal growth lines. Whorls more or less longitudinally ribbed, last whorl slightly tuberculate on the type; but the shells usually have little or no ribbing. Spire acute, outer lip dentate, strongly lirate within, columella lirate posteriorly. Length 34, width 24 mm.

Shorter and more globose than *S. cochlearis* Guppy. Type from Springvale where it is rather common.

Locality.—Springvale.

Horizon.—Upper Miocene.

Solenosteira cochlearis Guppy

Pl. 36, Fig. 3

Solenosteira cochlearis Guppy, 1910, Agr. Soc. Trinidad and Tobago, vol. 11, Paper No. 454, p. 7, pl. 2, fig. 3; Harris' Reprint, 1921, Bull Amer. Paleont., No. 35, p. 164, pl. 8, fig. 3.

Shell solid, subpyriform, more purpuroid and less globose than *S. semiglobosa*, and the tubercules on the shoulder are not confined to the last whorl. Spiral ridges triple or quadruple, crossed by rather strong, irregular growth lines. Lip dentate, canal moderately long. Length 41, width 25 mm.

The type was a very imperfect shell from Springvale.

Locality.—Springvale.

Horizon.—Upper Miocene.

Genus PHOS Montfort**Phos cf. erectus** Guppy

Phos erectus Guppy, 1874, Geol. Mag., London, p. 410, pl. 16, fig. 1.

Phos erectus Dall, 1896, Proc. U. S. Nat. Mus., vol. 19, No. 1110, p. 312.

We have a single specimen in the Trinidad material which resembles the Jamaican Miocene *Phos erectus* Guppy. It is, however, too imperfect for positive specific identification but is either that or a closely related species. The shell measures 30 mm. in height and 13 in greatest width.

Locality.—Brasso Venada Ravine, 3 miles east of Brasso Station, in west central Trinidad.

Horizon.—Manzanilla Miocene.

Genus ALECTRION Montfort**Alectrion brassica**, n. sp.

Pl. 36, Fig. 12

Shell small, broadly conic, spire acute. Three smooth nuclear whorls are followed by half a volution showing only fine, longitudinal riblets. Spirals then appear, there being about five on each of the two whorls preceding the final volution, and on the latter there are about sixteen. Longi-

tudinal ribs closely-set, well-marked, numbering twelve on the body whorl. Outer lip bordered by a strong terminal varix. Height 8, greatest width 5 mm.

This species is of the *Alectrion losquemadica-ambigua* group.

Locality.—Brasso Junction quarry.

Horizon.—Brasso Miocene.

Genus *COLUMBELLA* Lamarck

Columbella inflata var. *brassica*, n. var

Pl. 36, Fig. 8

Shell resembling the Dominican Miocene *Columbella inflata* Gabb, in the form of the upper portion; but differing markedly in the anterior angulation of the outer lip, the flexure of the canal, and the almost obsolete varix. It is also much smaller than *C. inflata*, measuring in length 17, greatest diameter 9, against 25 x 13 mm.

A rare form. Gabb found only one specimen of *inflata*, and my expedition found none in the Dominican Republic. And we have but a single shell of the variety in the Trinidad collection.

Locality.—Brasso District.

Horizon.—Middle Miocene.

Columbella asphaltoda Maury

Columbella asphaltoda Maury, 1912, Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 15, p. 81, pl. 12, fig. 2.

Shell with fine longitudinal riblets and spiral threads. Height 16, greatest width 7 mm.

Locality.—Brighton, 700 feet east of the pier, in impure asphalt.

Horizon.—Pliocene.

Columbella (Anachis) labreana Maury

Columbella labreana Maury, 1912, Jour. Acad. Nat. Sci. Phila., 2d

ser., vol. 15, p. 80, pl. 12, fig. 1.

A small species, somewhat akin to *Anachis obesa* C. B. Adams. Height 5, greatest width 2 mm.

Locality.—Brighton, 700 feet east of the pier, in impure asphalt.

Horizon.—Pliocene.

Genus *STROMBINA* Moersch

Strombina guaica, n. sp.

Pl. 36, Figs. 10, 11

Shell when entire with about eight whorls. The earliest are nuclear and smooth. The two or three following are closely and sharply longitudinally ribbed but not spirally sculptured. Subsequent whorls with longitudinal ribs (14 on the last volution) and strongly spirally sculptured with alternating bands and grooves. Outer lip within bearing anteriorly about eight denticles, and a shallow notch posteriorly. Inner lip callused, finely denticulate. Height 17, greatest width 7 mm.

This resembles somewhat *Strombina ambigua* (*Columbella ambigua* Guppy, Quart. Jour. Geol. Soc., 1866, p. 288, pl. 16, fig. 8) but that has spirals only towards the base of the body. It also resembles Sowerby's *venusta* (*Columbella venusta* Sowerby, Quart. Jour., 1849, p. 46, pl. 9, fig. 6) but that has a weaker varix, spirals on the early whorls, and the spire is less convex in form than in our shell.

Locality.—13th mile post, Guaico-Tamana Road.

Horizon.—Machapoorie Miocene.

Genus *CERITHIUM* Adanson

Cerithium harrisi Maury

Cerithium harrisi Maury, 1912, Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 15, p. 90, pl. 12, fig. 18.

A small, beaded and spirally striated species, 15 mm. in height and 5 in diameter.

Locality.—Brighton, 700 feet east of the pier.

Horizon.—Pliocene.***Cerithium isabellæ* Maury**

Cerithium isabellæ Maury, 1912, Jour. Acad. Nat. Sci., Phila., 2d ser., vol. 15, p. 91, pl. 12, fig. 19.

Differs from *C. harrisi* in its broader form, greater number of spirals and absence of varices. Height 16, diameter 8 mm.

Locality.—Brighton, 700 feet east of the pier, in impure asphalt.

Horizon.—Pliocene.***Cerithium tinkeri* Maury**

Cerithium tinkeri Maury, 1912, Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 15, p. 92, pl. 12, fig. 17.

Longitudinally ribbed, and the ribs interrupted by four or five impressed spirals, the one below the suture constituting a groove. Height 25 mm.

Locality.—Southern main road south of Pitch Lake, Brighton.

Horizon.—Upper Miocene.Genus **MUREX** LinnæusSubgenus **PHYLLONOTUS** Swainson***Murex (Phyllonotus) cornurectus* Guppy**

Murex (Chicoreus) megacerus Gabb, 1873, Trans. Amer. Phil. Soc., vol. 15, p. 202. Not *M. megacerus* Sowerby.

Murex cornurectus Guppy, 1876, Quart. Jour. Geol. Soc. London, vol. 32, p. 521, pl. 28, fig. 4.

Murex cornurectus Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, pp. 6, 9; Paper No. 454, p. 8; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, pp. 149, 151, 164.

Murex (Phyllonotus) cornurectus Maury, 1917, Bull. Amer. Paleont., No. 29, p. 103, pl. 16, figs. 9, 10.

Murex (Phyllonotus) cornurectus Hubbard, 1921, Sci. Surv. Porto Rico and the Virgin Islands, vol. 3, pt. 2, p. 150.

Murex cornurectus Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 131.

As in 1917, I follow Dr. Dall's advice in keeping *M. cornurectus* separate from *M. brevifrons* at least until

really careful study has been given to the entire *brevifrons* series.

We have from Trinidad an imperfect specimen of *Murex* with the varices heavy and ascending spirally upon the spire, and with a short tuberculate rib alternating with the varices on the body whorl. These characters and the form show that it is of the *cornurectus-brevifrons* group, but it is not sufficiently well preserved to figure.

Locality.—Springvale.

Horizon.—Upper Miocene.

Genus *TYPHIS* Montfort

Typhis alatus var. *obesus* Gabb

Pl. 36, Figs. 6, 9

Typhis obesus Gabb, 1873, Trans. Amer. Philos. Soc., vol. 15, p. 203.

Typhis alatus var. *obesus* Dall, 1890, Trans. Wagner Inst. Sci., vol. 3, p. 151.

Typhis obesus Pilsbry, 1922, Proc. Acad. Nat. Sci. Phila., p. 354, pl. 28, figs. 5, 6. (Gabb's type.)

As our specimen combines certain characters of *alatus* Sowerby (Quart. Jour. Geol. Soc. London, vol. 5, p. 48, pl. 10, fig. 4) with others of Gabb's *obesus*, I follow Dr. Dall in regarding *obesus* as a variety of *alatus*.

The tubes of our shell are worn, but the surface shows the marked spirals of *alatus* while the shell inclines to the form of *obesus*, being broad and short. Height 29, greatest width 20.

The type of *obesus* is Dominican, but this variety has also been found in the Chipolan Miocene of Florida.

Locality.—At the 11th mile post on Caparo Road.

Horizon.—Manzanilla Miocene.

Typhis linguiferus Dall

Pl. 35, Figs. 4, 5

In the collection are three specimens, probably the same as the Chipolan *linguiferus*, but both spines and tubes are broken, so a certain identification is not possible. On every whorl are four varices and alternating with the varices are the tubes. Presumably the varices when perfect ended in

spines. Height 14, greatest width 7 mm.

Locality.—13th mile post, Guaico-Tamana Road.

Horizon.—Machapoorie Miocene.

Genus *CYMIA* Moersch

***Cymia brightoniana* Maury, n. sp.**

Cymia woodii Maury, Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 15, p. 82, pl. 11, figs. 9, 10. Not *C. woodii* Gabb from Shiloh, N. J.
Cymia Henekeni Maury (*pro parte*), 1916, Bull. Amer. Paleont., No. 29, p. 105. Reference to Trinidad shells but not the figures, nor the Dominican specimens which are *henekeni*.

Further examination of the specimens indicates that the Trinidad shells are specifically distinct from the Dominican which I called *henekeni*. For the Trinidad species I suggest the name *brightoniana*.

Locality.—Brighton, 700 feet east of the pier.

Horizon.—Pliocene.

Genus *ACLIS* Lovèn

***Aclis* ? (*Amblyspira*) *teres* Guppy**

Aclis ? (*Amblyspira*) *teres* Guppy, 1896, Proc. U. S. Nat. Mus., vol. 19, p. 314, pl. 28, fig. 6.

Cadulus bed, Pointe-à-Pierre (Guppy).

Horizon.—Miocene.

Genus *MELANELLA* Bowdich

Subgenus *EULIMA* Risso

***Melanella* (*Eulima*) *egregia* Guppy**

Pl. 35, Fig. 3

Eulima egregia Guppy, 1896, Proc. U. S. Nat. Mus., vol. 19, No. 1110, p. 314, pl. 28, fig. 11.

Eulima egregia Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, pp. 5, 8; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, pp. 148, 150.

Shell turreted, smooth and polished, with about fourteen slightly convex whorls; suture well-marked, aperture sub-oval, columellar callus reflected over the body whorl. We

have one specimen exactly the size of the type, 29 mm. in height and 10 in width; but several broken shells indicate that this species attained 40 mm. or more in height and 13 or 14 in greatest width.

Dr. Guppy's types were collected in the Tertiary beds of Montserrat—in the same region as ours—and later he found this species also near Couva.

Locality.—Springvale, near Couva.

Horizon.—Upper Miocene.

Genus *TURBONILLA* Leach

Turbonilla plastica Guppy

Turbonilla plastica Guppy, 1896, Proc. U. S. Nat. Mus., vol. 19, p. 316, pl. 28, fig. 4.

Cadulus bed, Pointe-à-Pierre (Guppy).

Horizon.—Miocene.

Turbonilla (Stylopsis) octona Guppy

Turbonilla (Stylopsis) octona Guppy, 1896, Proc. U. S. Nat. Mus., vol. 19, p. 317, pl. 27, fig. 8.

Cadulus bed, Pointe-à-Pierre (Guppy).

Horizon.—Miocene.

Genus *DISTORTRIX* Link

Distortrix simillima Sowerby

Triton simillimus Sowerby, 1849, Quart. Jour. Geol. Soc. London, vol. 5, p. 48.

Persona simillima Guppy, 1866, Quart. Jour. Geol. Soc., vol. 22, p. 288, pl. 17, fig. 13; 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 158; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 37.

Distortrix simillimus Gabb, 1873, Trans. Amer. Phil. Soc., vol. 15, p. 212.

Persona simillima Guppy, 1874, Geol. Mag., London, p. 439; 1876, Quart. Jour. Geol. Soc., vol. 32, p. 522.

Distortrix simillima Dall, 1903, Trans. Wagner Inst. Sci., vol. 3, p. 1584.

Distorsio (Distortrix, Persona) gatunensis Toulou. 1908. Jahrb. der K.-K. Geol. Reichsanstalt. Wien, vol. 58, p. 700, pl. 25, fig. 10.

Persona simillima Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper

No. 440, p. 6; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 149.

Distorsio gatunensis Brown and Pilsbry, 1911, Proc. Acad. Nat. Sci. Phila., vol. 63, p. 356, pl. 26, fig. 8.

Distortrix simillima Maury, 1917, Bull. Amer. Paleont., No. 29, p. 107, pl. 17, fig. 4, 5.

Distorsio constrictus simillimus Pilsbry, 1922, Proc. Acad. Nat. Sci. Phila., vol. 73, p. 356.

Distortrix simillima Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 133.

As in 1917, I follow Zittel and Dall in using for this genus Link's name, *Distortrix*, 1807, because Bolten's name, *Distorsio*, although prior (1798), is based on Moerch, 1852. Montfort's *Persona* was given in 1810, two years after Link's.

In the Trinidad collection is a fragment of this species, of which a perfect specimen is figured in my Dominican Memoir, Bulletin 29. It resembles the living west coast *D. constricta*; but is still closer to a shell labelled *ringens* (Reeve) Newcomb, from St. Thomas, W. I., in the Newcomb collection, Cornell University.

Distortrix simillima is abundant and large in the Gurabo formation, Dominican Republic. It is also in the Bowden Miocene, Jamaica, and in the Gatun of Gatun, Canal Zone, and of Costa Rica.

Locality.—Brasso Venada Ravine, 3 miles east of Brasso Station.

Horizon.—Manzanilla Miocene.

Genus *BURSA* Bolten

Bursa crassa Dillwyn

Ranella crassa Dillwyn, Reeve, Conch. Icon., fig. 18b.

Ranella crassa Guppy, 1866, Quart. Jour. Geol. Soc. London, vol. 22, p. 288, pl. 18, fig. 9.

Ranella crassa Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 157;

Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 36.

Bursa crassa Gabb, 1873, Trans. Amer. Phil. Soc., vol. 15, p. 212.

Ranella crassa Guppy, 1876, Quart. Jour. Geol. Soc. London, vol. 32, p. 522.

Gyrineum crassum Dall, 1903, Trans. Wagner Inst. Sci., vol. 3, p. 1584.

Bursa crassa Maury, 1917, Bull. Amer. Paleont., No. 29, p. 108, pl. 17, figs. 6, 7.

Bursa crassa Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 134, pl. 15, fig. 19.

A basal fragment, showing the form and sculpture of this species, is in the Trinidad collection.

This form is present in the Miocene of the Dominican Republic, Jamaica, and Costa Rica, and is living in the West Indies.

Locality.—11th mile post on Caparo Road.

Horizon.—Manzanilla Miocene.

Genus *DOLIUM* Lamarck

Subgenus *MALEA* Valenciennes

Malea camura Guppy

Malea camura Guppy, 1866, Quart. Jour. Geol. Soc. London, vol. 22, p. 287, pl. 17, fig. 9; 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 158.

Malea ringens Gabb, 1873, Trans. Amer. Philos. Soc., vol. 15, p. 223. Not *ringens* Swainson.

Malea camura Guppy, 1874, Geol. Mag., London, p. 439; 1876, Quart. Jour. Geol. Soc., vol. 32, p. 525.

Malea camura Maury, 1917, Bull. Amer. Paleont., No. 29, p. 112, pl. 19, fig. 3.

Malea camura Jones, 1918, Jour. Geol., vol. 26, p. 741.

Malea camura Vaughan, 1919, Bull. 103, U. S. Nat. Mus., p. 561.

Malea camura Maury, 1920, Sci. Surv. Porto Rico and the Virgin Isls., New York Acad. Sci., vol. 3, pt. 1, p. 59.

A number of internal molds of this species are in the collection, and a perfect shell is figured from the Dominican Republic. The largest Trinidad mold is 50 x 35 mm.

The type of *camura* was Jamaican. It is also abundant in the Dominican Republic, and has been recorded from Gatun and from Haiti. It is also near Quebradillas, Porto Rico.

Locality.—Near 7¾ mile post on Guaico-Tamana Road.

Horizon.—Machapoorie Miocene.

Malea camura var. *elliptica* Pilsbry and Johnson

Malea elliptica Pilsbry and Johnson, 1917, Proc. Acad. Nat. Sci. Phila., vol. 69, p. 169; 1922, *Idem*, vol. 73, p. 363, pl. 39, fig. 3.

Malea elliptica Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 139,

pl. 12, fig. 2.

The variation in the spiral banding and relative width of grooves to bands in *Malea camura* Guppy, is protean. In my Dominican material all sorts of mutations present themselves. Closely banded specimens in Gabb's Dominican collections, Pilsbry and Johnson have named *elliptica*. A similar specimen before me measures 55 x 40 mm. A large, typical *camura* may attain 70 x 40 mm. (See Maury, Bull. 29, p. 113, pl. 19, fig. 3.) The living analogue is the west coast *ringens* Swainson.

In the Trinidad collection are three greatly distorted, crushed specimens of *camura*, closely banded, like the mutation *elliptica*.

Locality.—Quarry, $\frac{1}{2}$ mile above Brasso Station, No. 284.

Horizon.—Brasso Miocene, and uppermost member of that series.

Genus *CYPRÆA* Linnæus

Cypræa henekeni Sowerby

Pl. 37, Fig. 1

Cypræa Henekeni Sowerby, 1849, Quart. Jour. Geol. Soc. London, vol. 5, p. 45, pl. 9, fig. 3.

Cypræa Henekeni Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 160; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 39.

Cypræa Henekeni Gabb, 1873, Trans. Amer. Philos. Soc., vol. 15, p. 235.

Cypræa Henekeni Guppy, 1874, Geol. Mag., London, p. 440; 1876, Quart. Jour. Geol. Soc. London, vol. 32, p. 528.

Cypræa Henekeni Dall, 1890, Trans. Wagner Inst. Sci., vol. 3, p. 165.

Cypræa henekeni Guppy, 1912, Agr. Soc. Trinidad and Tobago, Paper No. 520, p. 3; Harris' Reprint, 1912, Bull. Amer. Paleont., No. 35, p. 186.

Cypræa Henekeni Maury, 1917, Bull. Amer. Paleont., No. 29, p. 114, pl. 19, fig. 4.

Typically, this shell attains a moderately large size, and has two prominent, rather symmetrically placed, tubercles which bear a fanciful resemblance to the ears of a mouse, or the widely open and questioning eyes of some bizarre creature. The modern descendant is *C. mus* variety *bicornis* Sowerby, of the Atlantic and Mediterranean faunas,

which, however, has a different color pattern from *henekeni*. Sometimes the tubercles are absent or only one is developed in *henekeni* but our many Dominican Miocene specimens show that there is almost always at least a trace of them.

In the Trinidad collection is a single shell that agrees very well with the Dominican specimens in form and general aspect, except that the edges are more corrugated, but some of them show this feature nearly as much, although often the sides are smooth. The Trinidad shell happens to have only one tubercle, but it is in the right place. Length 54, height 28, width 38 mm.

The variety mentioned by Brown and Pilsbry from Gatun (Proc. Acad. Nat. Sci. Phila., 1911, p. 356, pl. 26, figs. 9, 10) is very much more corrugated. *C. almirantensis* Olsson, from the Gatun stage, Water Cay, Panama, is longer and narrower than *henekeni*, measuring 60 x 30 x 38 mm., and the tubercles are lower and more lumpy, but it is a member of the *henekeni* group.

Dr. Guppy recorded *henekeni* from Springvale.

Locality.—11th mile post on Caparo Road (west central Trinidad).

Horizon.—Manzanilla Miocene.

***Cypræa henekeni* var. *lacrimula*, n. var.**

Pl. 37, Fig. 2

From Central Trinidad we have an incomplete *Cypræa* resembling somewhat *C. henekeni* Sowerby. But instead of the two tubercles, this Trinidad shell has on one side a cluster of three, and on the other of two, conspicuous tear-shaped blisters. There is also a fourth near the margin of the aperture. The sides of the shell have been crumpled by pressure, but they may have been somewhat corrugated. The tear-like clusters are certainly natural, and not due to deformation, and give the shell an amusingly lachrymose air. The specimen is 45 mm. in width.

Locality.—Eastern E 24, No. 407 (central Trinidad).

Horizon.—Machapoorie Miocene.

Cypræa caroniensis, n. sp.

Pl. 37, Figs. 3, 5, 6

Shell very large, the youngest specimen with the back very high and humped, resembling in form the recent *Cypræa stercoraria* var. *rattus* Lamarck and *C. decipiens* Smith. An older incomplete shell, 60 mm across, shows that with age the shell became proportionately flatter and attained a very large size. This specimen has a single, prominent, horn-like tubercle near the center of the back, somewhat to one side. A trace of this tubercle is apparent in a smaller adult shell, but the adolescent shell does not show it, though it may have been broken off. Aperture curving; teeth coarse, rather distant, becoming obsolete. Width of smaller adult shell 50, height 35, approximate length 70 mm. Estimated length of largest shell 75 to 80 mm.

The large Dominican species, *C. noueli* Maury, from Cercado de Mao, is more evenly globose and bears no trace of tubercles.

Locality.—Springvale.

Horizon.—Upper Miocene.

Genus *STROMBUS* Linnæus*Strombus bifrons* Sowerby

Pl. 36, Fig. 2

Strombus bifrons Sowerby, 1849, Quart. Jour. Geol. Soc. London, vol. 5, p. 48, pl. 9, fig. 9.

Strombus bifrons Guppy, 1866, Quart. Jour., vol. 22, p. 287; 1876, vol. 32, p. 521.

Strombus bifrons Dall, 1890, Trans. Wagner Inst. Sci., vol. 3, p. 176; 1903, *Idem*, p. 1584.

Strombus bifrons Maury, 1917, Bull. Amer. Paleont., No. 29, p. 119, pl. 20, figs. 2, 3.

Strombus cf. *bifrons* Maury, 1920, Sci. Surv. Porto Rico and the Virgin Islands, New York Acad. Sci., vol. 3, pt. 1, p. 56.

Two fragments of this species are in the collection. A perfect shell is figured from the Dominican Republic which is the type locality. It is the most attractive of all the Miocene Antillean Strombs. The living analogue is the Oriental *S. columba*.

S. bifrons is present in both the Gurabo and Cercado

formations of the Dominican Middle and Lower Miocene; in the Bowden beds, Jamaica; and a mold probably of this shell was collected by Dr. Reeds on Señor Rabell's ranch, Rio Guajataca, Porto Rico. Its range is now extended to Trinidad.

Locality.—At the 13th mile post, Guaico-Tamana Road.

Horizon.—Machapoorie Miocene.

Genus *CLAVA* Martyn

Clava venada, n. sp.

Pl. 41, Fig. 10

Shell tapering, with about twelve whorls which increase fairly rapidly in diameter. Last whorl with a conspicuous rounded varix on the left side of the aperture. Sculpture on each volution of three major, strongly nodose, spirals, alternating with a finer thread in each interspace. Outer lip lacking, and columella concealed. Height 29, greatest diameter 11 mm.

This species resembles the Dominican Miocene *Clava plebeia* Sowerby; but the diameter of the Trinidad shell is greater (10-11 against 8-9) and the sculpture is coarser than in typical specimens of Sowerby's species.

In the *Errata* of Bull. Amer. Paleont., No. 29 (after the last plate), I noted that the genus *Clava* had been accidentally misplaced in my Dominican Memoir.

From the Gatun of Costa Rica, Mr. Olsson has described *Clava costaricana* and *C. alajuela*. The former is much larger (measuring 40 x 15), and the latter smaller and slendered (17 x 6) than the Trinidad shell.

Locality.—Brasso Venada Ravine, 3 miles east of Brasso Station.

Horizon.—Manzanilla Miocene.

Genus *PYRULA* Lamarck

Pyrula trinitaria, n. sp.

Pl. 41, Figs. 9, 12

Shell large, fig-shaped, ventricose, with six whorls, of which the first two and a half to three are entirely smooth, embryonic; later whorls cancellated. The fully developed sculpture on the last volution is elegant and sharply defined. It consists of strong, primary spiral threads at intervals of about four millimetres, and centrally placed between every pair of these primary spirals is a finer, secondary thread, with a still finer tertiary lying on either side, and on either side of each tertiary lies a yet more delicate thread—making in all seven threads between every pair of primaries. Sometimes the finest threads are lacking, so there are but five between the primaries. The primaries and secondaries stand out delicately but clearly. The spirals are crossed by fine, closely-set, longitudinal threads about the thickness of the secondary spirals. There is no trace of knotting at the intersections. Greatest width of adult shell 40 mm., approximate height 70 mm. The nearest affinity of this species is the Pacific *Pyrula ventricosa* Sowerby, which has five to seven finer spirals between every pair of primaries, but the primaries are stronger and more distant in *ventricosa*.

Other east coast fossil forms with west coast affinities are *Pyrula hoveyi* Maury, from the Porto Rican Miocene, akin to *P. reticulata* Lamarck; and *P. micronematica* Brown and Pilsbry, from the Canal Zone, akin to *decussata* Wood. But *hoveyi* has strong axial threads equalling the primary spirals; and *micronematica* has rather widely-spaced axials knotted at their intersections with the spirals, and the type was small, measuring only 28 mm.

According to Mr. Burnett-Smith (Proc. Acad. Nat. Sci. Phila., p. 217, 1907), in the genetic development of *Pyrula* there is a law of progressive reduction in the number of smooth, embryonic whorls, exemplified by the $2\frac{1}{2}$ –3 smooth whorls in the Vicksburgian *P. mississippiensis* and the single smooth whorl in the modern *P. papyratia*. Our Trinidad species shows the ancestral character of possessing nearly three smooth whorls.

Locality.—Springvale.

Horizon.—Upper Miocene.***Pyrula carbasea* Guppy**

Pl. 41, Fig. 5

Ficula carbasea Guppy, 1866, Quart. Jour. Geol. Soc., vol. 22, p. 580, pl. 26, fig. 7.

Ficula carbasea Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 158; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 37.

Ficula carbasea Guppy, 1873, Proc. Sci. Assoc. Trinidad, vol. 2, p. 80; Harris' Reprint, 1921, p. 64.

Ficus mississippiensis Gabb, 1873, Trans. Amer. Philos. Soc., vol. 15, p. 223.

Not *Ficula mississippiensis* Conrad, 1847, Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 1, p. 117.

Ficula carbasea Guppy, 1874, Geol. Mag., p. 439.

Ficula mississippiensis Guppy, 1876, Quart. Jour. Geol. Soc., vol. 32, p. 525.

Ficula carbasea Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, p. 10; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 152.

Pyrula carbasea Maury, 1920, Sci. Surv. Porto Rico and the Virgin Islands, vol. 3, pt. 1, p. 60.

Shell with a low spire and sunken suture, when adult with five whorls, of which the first $1\frac{1}{2}$ to $1\frac{3}{4}$ are smooth. Later volutions sculptured with spiral threads of which there are typically three finer between every two of the larger threads. Spirals cancellated by axials about equaling the finer spirals in thickness. Interspaces appearing slightly concave because of the prominence of the major spirals. The type measured about 65 x 45 mm. Our shell is young and only 35 x 24 mm.

This species has the same sort of sculpture as *mississippiensis*, but that is much smaller, with a higher spire, and with $2\frac{1}{2}$ to 3 smooth, embryonic whorls.

Locality.—Springvale.

Horizon.—Upper Miocene.

Genus *SERPULORBIS* Sasso***Serpulorbis decussata* Gmelin**

Pl. 41, Fig. 3

Serpula decussata Gmelin, 1791, Syst. Nat., 13, p. 3745.

Siphonium decussatum Guppy, 1864, Trans. Sci. Assoc. Trinidad, p. 35; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 15.

- Vermetus decussatus* (Moerch) Tryon, 1886, Man. Conch., vol. 8, p. 181, pl. 53, fig. 71.
Serpulorbis decussata Dall, 1892, Trans. Wagner Inst. Sci., vol. 3, p. 304; 1915, Bull. U. S. Nat. Mus., No. 90, p. 96.

From the quarry near Springvale, we have a poorly preserved specimen which resembles the Miocene to Recent *Serpulorbis decussata* Gmelin. It is not nearly so handsomely reticulated by the granules as the Dominican Miocene specimen that I referred to *granifera* Say; but the sculpture is chiefly of very closely-set, longitudinal, granular striæ. The tube measures 6 mm. in diameter.

From Matura we have a number of small tubes, seemingly also of this species. The largest is 4 mm. in diameter.

S. decussata first appeared in the Tampa Oligocene of Florida.

It is now living from North Carolina southward through the Antilles.

Localities.—11th mile post on Caparo Road; Springvale; Matura.

Horizons.—Manzanilla Miocene; Springvale Miocene; Pliocene.

***Serpulorbis papulosa* Guppy**

- Vermetus papulosus* Guppy, 1866, Quart. Jour. Geol. Soc., vol. 22, p. 292, pl. 17, fig. 3.
Vermetus papulosus Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 155; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 35.
Petalococonchus sculpturatus Gabb, 1873, Trans. Amer. Philos. Soc., vol. 15, p. 241. Not of H. C. Lea.
Vermetus papulosus Guppy, 1874, Geol. Mag., p. 437; 1876, Quart. Jour. Geol. Soc., vol. 32, p. 519.
Serpulorbis papulosa Dall, 1892, Trans. Wagner Inst. Sci., vol. 3, p. 303; *Idem*, 1903, p. 1585.
Serpulorbis papulosa Maury, 1917, Bull. Amer. Paleont., No. 29, p. 127, pl. 22, fig. 10.
Serpulorbis papulosa Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 145, pl. 12, fig. 1.

We have from Springvale several worn tubes which here and there show rows of tubercles and are probably this species. And from Brasso is a small but well preserved bit, showing the rows of papillæ with the crenate

longitudinal striations in the interspaces. This measures 8 mm. in diameter.

A very fine Dominican specimen from the Gurabo formation is figured in Bulletin 29. Frequently there are three striæ in each interspace, but this is a variable feature, for there may be but one, as in Mr. Olsson's Costa Rican specimens. The type locality was Bowden, Jamaica.

Localities.—Springvale; Brasso Creek.

Horizons.—Springvale Miocene; Manzanilla Miocene.

Genus *PETALOCOCHUS* H. C. Lea

In the discussion of the *Vermetidæ* I follow Dr. Dall (Bull. U. S. Nat. Mus., No. 90, pp. 95, 96, 1915) in regarding *Petalococonchus* and *Vermicularia* as of generic rank.

Petalococonchus sculpturatus var. *domingensis* Sowerby

Pl. 41, Figs. 2, 4, 7

- Petalococonchus domingensis* Sowerby, 1849, Quart. Jour. Geol. Soc. London, vol. 5, p. 51, pl. 10, figs. 9a, b, c.
Petalococonchus sculpturatus Guppy, 1876, Proc. Sci. Assoc. Trinidad, p. 156; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 35.
 Cf. *Petalococonchus sculpturatus* H. C. Lea, 1845, Trans. Amer. Philos. Soc., 2d ser., vol. 9, p. 233, pl. 34, fig. 3.
Petalococonchus sculpturatus Gabb, 1873, Trans. Amer. Philos. Soc., vol. 15, p. 240.
Petalococonchus sculpturatus Guppy, 1874, Geol. Mag., London, p. 438; 1876, Quart. Jour. Geol. Soc., vol. 32, p. 519.
Vermetus (*Petalococonchus*) *sculpturatus* Dall, 1892 (in part), Trans. Wagner Inst. Sci., vol. 3, p. 305.
Vermetus (*Petalococonchus*) *pulcher* Bose, 1906, Boletín Inst. Geol. de Mexico, No. 22, p. 32, pl. 3, figs. 22, 23.
Petalococonchus sculpturatus Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, pp. 5, 10; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, pp. 148, 153.
Petalococonchus domingensis Pilsbry and Brown, 1911, Proc. Acad. Nat. Sci. Phila., vol. 63, p. 359.
Petalococonchus domingensis Maury, 1917, Bull. Amer. Paleont., No. 29, p. 128, pl. 22, fig. 11.
Petalococonchus domingensis Hubbard, 1921, Sci. Surv. Porto Rico and the Virgin Isls., vol. 3, pt. 2, p. 139.
Petalococonchus sculpturatus Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 146, pl. 14, figs. 10, 15.
Vermetus (*Petalococonchus*) *domingensis* Pilsbry, 1922, Proc. Acad. Nat. Sci. Phila., vol. 73, p. 377.

The species *sculpturatus* was made by H. C. Lea, the

type of his genus *Petalococonchus*. In 1892, Dr. Dall reduced *Petalococonchus* to a subgenus of *Vermetus* and this has been followed by Pilsbry and some others, but in 1915 Dr. Dall restored *Petalococonchus* to generic rank.

Sowerby's species *domingensis* was based on Heneken's shell from the Miocene of Santo Domingo. As the above synonymy indicates, *domingensis* has by some writers been united with *sculpturatus*, and by others held distinct. Sowerby's figure so perfectly represents the usual Dominican form that, in 1917, I retained his species. But now I have from Trinidad the widening cylinders typical of the coiling of *domingensis* and also one tapering cone similar to the form frequently assumed by *sculpturatus*. But the whorls of the Antillean shells are much flattened and *domingensis* may perhaps be best regarded as a variety of Lea's species.

We have quite a number of these oddly coiled, tubular shells in the Springvale material. The majority are sub-cylindrical, about 44–34 mm. long and 16–20 at their greatest diameter. The largest shows well the characteristic obsolescence of the coiling and measures 80 x 20 with a maximum diameter of the tube of 7 mm.

From Brasso we have a small coil which, like the young Springvale coils, shows about three spirals to a volution, crossed by coarse, irregular growth lines. It is only 14 x 11 x 4 mm.

Localities.—Springvale; $\frac{3}{4}$ mile south of Brasso.

Horizons.—Springvale Miocene; Manzanilla Miocene.

Genus *VERMICULARIA* Lamarck

Vermicularia spirata Philippi

Pl. 41, Fig. 13

Vermiculus spiratus Philippi, 1836, Arch. für Naturg., p. 244.

Vermetus (*Vermicularia*) *spiratus* Tryon, 1886, Man. Conch., p. 187, pl. 55, fig. 99.

Serpulorbis (*Vermicularia*) *spirata* Dall, 1892, *pro parte*, Trans. Wagner Inst. Sci., vol. 3, p. 304.

Vermicularia spirata Maury, 1922, Bull. Amer. Paleont., No. 38, p. 102.

In the recent fauna this species is quite a large shell. In early stages it coils evenly and closely, in excellent imitation of a *Turritella*, and the longitudinal ridges then appear as spirals. But in later stages of growth the coils are not contiguous. The range is from Massachusetts Bay to the southern Antilles.

The figured specimen is from Florida. It measures 65 mm. in height and 9.5 in greatest diameter.

Horizon.—Recent.

***Vermicularia spirata* var. *trilineata* Guppy**

Pl. 41, Fig. 6

Vermetus royanus (d'Orbigny) Guppy, 1864, Trans. Sci. Assoc. Trinidad, p. 34; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 15.

Vermetus trilineatus Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, pp. 156, 170; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, pp. 35, 49.

Vermetus trilineatus Guppy, 1874, Geol. Mag., London, p. 437.

Dr. Dall thought Guppy's *trilineata* was a young shell of Gmelin's *spirata* and placed it in the synonymy of that species. (Trans. Wagner Inst. Sci., vol. 3, p. 304, 1892). But we have a number of specimens from Guppy's type locality and they are uniformly very small. For this miniature Pliocene form it would seem appropriate to retain Dr. Guppy's name *trilineata* as a variety. But the three ridges are equally characteristic of *spirata* as of the dwarf form. A shell of the latter measures in height 13 and the greatest diameter of the tube is 4 mm.

Locality.—Matura.

Horizon.—Upper Pliocene.

***Vermicularia* cf. *radicula* Stimpson**

Pl. 41, Fig. 1

Vermetus lumbricalis Gould, 1841, Inv. Mass., 1st ed., p. 287. Not of Linnæus.

Vermetus radicula Stimpson, Shells of New England, p. 37.

Vermetus lumbricalis Guppy, 1864, Trans. Sci. Assoc. Trinidad, p. 34; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 15.

Vermetus radicula Binney's Gould, 1870, Inv. Mass., 2d ed., p. 316, fig. 584.

Vermetus lumbricalis Guppy, 1874, Geol. Mag., p. 437.

The *lumbricalis* of Linnæus is Oriental, yet very similar forms are found on the Atlantic coast of the United States and in the Antilles. To these Stimpson gave the name *radicula*. This Tryon placed as a variety of *spirata* Philippi, and Dall placed it in the synonymy of *spirata*. But Tryon's figure of *radicula* (pl. 55, fig. 100) does not resemble Stimpson's figure of his species—Tryon's being strongly tricarinate, while Stimpson's is not, and looks much more like *lumbricalis*.

We have a carinate *Serpulorbis* from Springvale resembling *lumbricalis*, and Guppy had specimens from Matura that he referred to *lumbricalis*.

Judging from the figures of the types, *spirata* has about three to five strong, longitudinal carinæ, while *lumbricalis* and *indicus* have one ridge which is more prominent and carinates the tube. It seems clearer to retain Stimpson's name *radicula* for Atlantic shells resembling the Oriental *lumbricalis*.

As our specimen is not well preserved, and as neither *spirata* nor *radicula* have been reported from beds older than Pliocene, the Springvale shell is not identified with certainty.

Localities.—Matura (Guppy). Doubtful shell, Springvale.

Horizons.—Recent, Pliocene and perhaps also Upper Miocene.

Genus *TURRITELLA* Lamarck

Turritella gatunensis Conrad

Pl. 42, Fig. 12

Turritella gatunensis Conrad, 1857, Pacific Railroad Rept., vol. 6, p. 72, pl. 5, fig. 10.

Turritella conradi Toula, 1909, Jahrb. der K-K. Geol. Reichsanstalt, Wien, vol. 58, p. 694, pl. 25, fig. 4.

Turritella gatunensis Brown and Pilsbry, 1911, Proc. Acad. Nat. Sci. Phila., vol. 63, p. 358, pl. 27, figs. 4, 5, 9.

Turritella gatunensis Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 148, pl. 14, figs. 12, 13.

In the Trinidad collection are a number of *Turritellas* which resemble in all respects specimens obtained by Mr. Olsson at the type locality, Gatun.

This species has gently convex whorls, overhanging the following volutions, spirally striated, and with a constricted central zone. The shell is never large, when complete about 40 mm. long. The adult Trinidad specimens are all fragmentary. One specimen of four whorls is 21 x 11 mm. in greatest diameter.

Localities.—Near bridge at Tamana Road Junction; $\frac{3}{4}$ mile south of Brasso; Brasso Creek.

Horizon.—Manzanilla Miocene.

Turritella trinitaria, n. sp.

Pl. 42, Fig. 10

Shell large, increasing quite rapidly, whorls gently convex, basally carinate, excavated sharply and deeply beneath the carina, not overhanging the following volution. Each whorl is sculptured with about a dozen unequal, coarse, spiral threads, tending to alternate in strength. Of the spirals, two are much stronger than the rest. These major spirals are on the lower half of the whorls and the basal one edges the carination. Between it and the upper major thread is a slender spiral. This produces somewhat the effect of a cingulation, but the zone included by the major spirals is not constricted. One specimen of about five whorls is 45 mm. in height and 25 in greatest diameter; the other, of three whorls, is 35 x 25 mm. This large and handsome shell is a little like a giant *T. gatunensis*, but the whorls do not overhang and are not constricted centrally. *T. lloydsmithi* Pilsbry and Brown, from the Miocene of Cartagena, Colombia, tapers more gradually than this Trinidad species, and has nearly flat whorls with about half as many spirals.

Locality.—Springvale.

Horizon.—Upper Miocene.

Turritella altilira var. *tornata* Guppy

Pl. 42, Figs. 3, 4, 5

- Turritella tornata* Guppy, 1866, Quart. Jour. Geol. Soc. London, vol. 22, p. 580, pl. 26, fig. 12.
Turritella tornata Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 156; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 35.
Turritella tornata Guppy, 1873, Proc. Sci. Assoc. Trinidad, vol. 2, p. 79; Harris' Reprint, 1921, Bull. 35, p. 63.
Turritella tornata Gabb, 1873, Trans. Amer. Phil. Soc., vol. 15, p. 240.
Turritella tornata Dall, 1892, Trans. Wagner Inst. Sci., vol. 3, p. 312.
Turritella tornata Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 454, p. 4; Harris' Reprint, 1921, Bull. 35, p. 160.
Turritella tornata Guppy, 1913, Agr. Soc. Trinidad and Tobago, Paper No. 549, p. 2; Harris' Reprint, 1921, Bull. 35, p. 189.
Turritella tornata Maury, 1917, Bull. Amer. Paleont., No. 29, p. 130, pl. 22, fig. 15.

Typically *Turritella tornata* has on every whorl two beaded spiral keels, and in the concavity between them two fine, granose spiral threads, and a granular spiral line lies above the upper keel, just beneath the suture.

But the following mutations occur: (1) the beading is variable, (2) the spiral threads may increase or diminish. Thus, among the Brasso Creek (Manzanilla Miocene) specimens, some have three main spirals in the concavity, while others have two main and four secondary threads, six in all. On the other hand, practically all the Machapoorie, Quarry (Machapoorie Miocene) specimens have no spirals in the concavity, or some, one faint line. Among the specimens from Tamana Road Junction (Manzanilla Miocene) the subsutural spiral is increased to the size of a keel, so that the upper keel appears paired. Specimens from the limestone forming the top of the Brasso Miocene lack the subsutural spiral but the upper keel is extra heavy.

Along with these mutations, however, a shell with typical sculpture may be present, so that the mutations are hardly of stratigraphic value, although the Machapoorie shells certainly strongly tend to absence of spirals in the concavity.

Dr. Guppy's figured type was a young shell from Cumana, Venezuela, and in writing his description he had specimens from Jamaica and Santo Domingo. He later identified the Springvale form as this species.

We have a quantity of specimens but none perfect. Large fragments of lower whorls measure 17 mm. in diameter, so that, as the shells taper gradually, the complete length must have been considerable. Terminal portions are long and slender, as 35 x 9 mm.

T. tornata is of Conrad's *atitlira* race, and so closely allied that it may perhaps best be ranked as a variety of that species. Some Trinidad specimens are almost exactly like *T. atitlira* var. *chiriquiensis* Olsson, from the Costa Rican Miocene. Others with the double upper keel and three spirals in the concavity approach the beautiful *T. atitlira culebrina* Maury, from the Porto Rican Miocene.

Localities.—Brasso Creek; Springvale; Southwest quarter of E 24; $\frac{3}{4}$ mile south of Brasso; 11th mile post on Caparo Road; Brasso Junction; near bridge at Tamana Road; Blue clay above the calcareous bed represented by No. 284; 13 $\frac{1}{2}$ miles on Cunapo Southern Road; 7 $\frac{3}{4}$ miles on Guaico-Tamana Road; 13 miles on Guaico-Tamana Road; Brasso Venada Ravine 3 miles east of Brasso Station; Brasso Junction quarry; Brasso Creek; Machapoorie quarry; $\frac{1}{2}$ mile above Brasso Station; N. W. $\frac{1}{4}$ F. 16; Eastern E 20; Central E 20; 1 mile west of Erin Point.

Horizons.—Machapoorie Miocene; Manzanilla Miocene; Brasso Miocene; Lower Springvale and Springvale Miocene. (Very scarce in the last two).

***Turritella planigyrate* Guppy**

Pl. 42, Figs. 6, 7, 8

Turritella planigyrate Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, pp. 156, 169; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, pp. 35, 48.

Turritella planigyrate Guppy, 1874, Geol. Mag., London, p. 408, pl. 18, fig. 5.

Cf. *Turritella planigyrate* Guppy, 1876, Quart. Jour. Geol. Soc. London, vol. 32, p. 519.

Turritella planigyrate Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, pp. 5, 11; Harris' Reprint, 1921, Bull. 35, pp. 148, 153.

In this species the whorls are slightly convex to nearly

flat, very rarely the later whorls show a slight overhang basally. The sculpture is of very fine spiral lines. Aperture subquadrate. An average adult Springvale specimen, which comprises twelve whorls, is 64 mm. in height and 18 in greatest diameter. A very large fragment from Springvale, seemingly the same species, comprises five whorls and is 65 x 25 mm.

The Dominican *Turritella* that I figured in Bulletin 29 as *T. planigyrate* has coarser spirals, but the form is not unlike some of the Trinidad shells.

In general aspect *T. planigyrate* (especially the examples with the slight overhang) recalls *T. minetes* Brown and Pilsbry, from Gatun, but the spirals of the Trinidad species are finer and closer.

Of recent forms *T. planigyrate* is not unlike *T. variegata* var. *meta* Reeve, now living on the shores of Trinidad (See Plate 42, Figure 9); but the fossil shell is more finely sculptured. Besides Springvale, where Dr. Guppy had also collected *T. planigyrate*, Professor Harris found a new and very interesting location on the road leading west of Brasso Junction. At that point there is a blue clay stratigraphically 75-100 feet above the limestone that ends the Brasso section. This blue clay is the base of the Springvale Miocene and in it are shells of *planigyrate*. This seemed to be the earliest appearance of this species; but there is a fragment exactly like Springvale specimens, from the Manzanilla Miocene, on Caparo Road.

Localities.—Springvale; Road leading west of Brasso Junction; 11th mile post on Caparo Road; Brasso Creek.

Horizons.—Springvale and Lower Springvale Miocene; Manzanilla Miocene. (Very scarce in the latter).

Turritella cartagenensis Pilsbry and Brown

Pl. 42, Fig. 13

Turritella cartagenensis Pilsbry and Brown, 1917, Proc. Acad. Nat. Sci. Phila., vol. 69, p. 34, pl. 5, fig. 13.

In the Trinidad collection, we have a fragment com-

prising two later whorls of a *Turritella* which corresponds to the discription and figure of *T. cartagenensis* Pilsbry and Brown, from the Miocene near Cartagena, Colombia. The shell is large with slightly concave whorls, sculptured with fine, somewhat unevenly spaced and unequal, spiral threads. The slight concavity of the whorls differentitates it from larger specimens of *T. planigyrate* Guppy. Height of two lower whorls 29 mm., diameter 22.

This species is related to *T. oreodoxa* Olsson, from the Miocene of Costa Rica; but in that shell the whorls are more concave and much swollen beneath the sutures.

Locality.—At the 11th mile post on Caparo Road.

Horizon.—Manzanilla Miocene.

***Turritella caparonis*, n. sp.**

Pl. 42, Figs. 1, 2

Adult shell large, increasing rather rapidly. Earlier whorls sculptured with three equal, equidistant, finely beaded, high, narrow, spiral ridges, and at the suture a smooth spiral thread. With age, the whorls develop one or two very fine, crenate striæ above the uppermost ridge, and the sutural thread becomes heavier and may be somewhat crenate. The interspaces between the three ridges are concave and smooth. The beading shows only on unworn specimens. The oldest fragment, of about four basal whorls, is 35 mm. in height and 17 in greatest diameter. A younger of about ten whorls measures 45 x 15 mm.

Localities.—Caparo Road; Guaico-Tamana Road at 7¾ miles; E 24 (No. 391); Machapoorie quarry; Guaico-Tamana Road at 13th mile post.

Horizons.—Manzanilla Miocene; Brasso Miocene; Machapoorie Miocene.

***Turritella machapoorensis*, n. sp.**

Pl. 42, Fig. 11

Among the *Turritellas* from Machapoorie is a specimen unlike *T. caparonis*. The shell tapers rapidly, the whorls are very flat with the suture ill-defined. The sculpture on

each volution consists of two strong, basal spirals followed by a concave zone with two fine, secondary, spiral threads, and sometimes also tertiary striæ. Above the concavity is a third major, strong, spiral and about three fine subsutural spiral threads. So there are three major and five or six minor spirals to a whorl. Although the specimen is well preserved, the spirals show no traces of beading. An apical fragment of about thirteen whorls, two of which are smooth and nuclear, is 29 mm. in height and 11 in greatest diameter.

Locality.—Machapoorie quarry, in the northwestern part of the Department of Nariva.

Horizon.—Machapoorie Miocene.

Genus *HEMISINUS* Swainson

Hemisinus comparanus, n. sp.

Pl. 35, Figs. 9, 10

Hemisinus sulcatus Guppy, 1908, Bull. Misc. Inform., Botanical Dept., Trinidad, p. 114; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 140.

Not *Hemisinus sulcatus* Conrad, 1871, Amer. Jour. Conch., vol. 6, pt. 3, p. 194, pl. 10, fig. 2.

From the freshwater beds of Comparo Road, associated with *Corbicula*, we have specimens of a *Hemisinus*, presumably the same that Dr. Guppy had from the same locality and referred to *H. sulcatus* Conrad.

Comparison of our shells with Conrad's description and figure show about fourteen spirals on the last volution against twenty-three; and the body whorl is much more convex than in Conrad's shell, which was from Pichua, 30 miles below Pebas, 2200 miles up the Amazon Valley.

As is common in fluviatile shells, our specimens are all much eroded from CO₂ in the water, so that the earlier whorls are lacking, and the shells appear truncated. The subsequent whorls are sculptured with alternating spiral grooves and bands. On the whorls of the spire there are six bands to a volution, and on the last whorl about fourteen; aperture, when complete, showing a short basal canal.

Young shells are more slender, but adult specimens tend to much greater convexity. Height of decollate shell 25, greatest width 11 mm.

Locality.—Half a mile on Comparo Road, northeastern Trinidad.

Horizon.—Lower Pliocene.

Genus *ARCHITECTONICA* Bolten

Architectonica granulata Lamarck

Pl. 40, Fig. 1

Solarium granulatum Lamarck, 1822, Anim. sans Vert., 7, p. 3; 1792, Ency. Méthod, pl. 446, fig. 5a-b.

Architectonica perspectiva Tuomey and Holmes, 1857, Pleioc. Fos. S. Car., p. 120, pl. 26, fig. 6. Not *S. perspectiva* Linnæus, nor of Lamarck.

Solarium granulatum Dall, *pro parte*, 1892, Trans. Wagner Inst. Sci., vol. 3, p. 329.

Solarium gatunense Toula, 1908, Jahrb. der K.-K. Geol. Reichsanstalt, Wien, vol. 58, p. 693, pl. 15, fig. 3.

Solarium granulatum Maury, 1917, Bull. Amer. Paleont., No. 29, p. 131, pl. 23, fig. 3.

Architectonica granulata Maury, 1922, Bull. Amer. Paleont., No. 38, p. 108.

Architectonica granulata Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 154, pl. 13, figs. 10, 11, 12.

This ancient, very static species, has remained unchanged from Lower Miocene time. Like the more dainty, but closely allied, Dominican species, *A. quadriseriata* Sowerby, the sculpture is of four spiral bands to each volution. These on the earlier whorls in *A. granulata* are beaded and sometimes the bands of the last volution are also crenate: but frequently they are smooth. We have two specimens from Trinidad, one with the bands on the body beaded, the other with them smooth. The maximum diameter of the former shell is 30, height 12 mm.

A. granulata is found in the Miocene of Florida, Dominican Republic and Costa Rica; and is living in the Antilles, and on the Pacific coast in the Panamic Province.

Localities.—Springvale; Brasso Venada Ravine, 3 miles east of Brasso Station; 11th mile post on Caparo Road.

Horizons.—Springvale Miocene; Manzanilla Miocene.

Architectonica quadriseriata Sowerby

Solarium quadriseriatum Sowerby, 1849, Quart. Jour. Geol. Soc. London, vol. 5, p. 51, pl. 10, figs. 8a, b, c.

Solarium quadriseriatum Guppy, 1866, Quart. Jour. Geol. Soc., vol. 22, p. 291.

Architectonica quadriseriata Gabb, 1873, Trans. Amer. Phil. Soc., vol. 15, p. 228.

Solarium quadriseriatum Guppy, 1874, Geol. Mag., London, p. 438.

Solarium quadriseriatum Dall, 1903, Trans. Wagner Inst. Sci., vol. 3, p. 1585.

Solarium quadriseriatum Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, p. 8; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 151.

Solarium quadriseriatum Maury, 1917, Bull. Amer. Paleont., No. 29, p. 131, pl. 23, figs. 1, 2.

A single imperfect specimen is in the Trinidad material.

In the Dominican Republic it is in both the Gurabo and Cercado formations.

Locality.—Brasso Creek, Trinidad.

Horizon.—Manzanilla Miocene.

Genus *RISSEA* Fréminville**Risseea (Alvania) pariana** Guppy

Risseea (Alvania) pariana Guppy, 1896, Proc. U. S. Nat. Mus., vol. 19, p. 321, pl. 29, fig. 9.

Cadulus bed, Pointe-à-Pierre (Guppy).

Horizon.—Miocene.

Genus *BENTHONELLA* Dall**Benthonella turbinata** Guppy

Benthonella turbinata Guppy, 1896, Proc. U. S. Nat. Mus., vol. 19, p. 321, pl. 27, fig. 10.

Cadulus bed, Pointe-à-Pierre (Guppy).

Horizon.—Miocene.

Genus *MODULUS* Gray**Modulus tamanensis**, n. sp.

Pl. 40, Figs. 2, 3

Shell rather stout, broadly conic, nuclear whorls lack-

ing. Subsequent volutions sculptured with a strong, round, cord-like carina on which the suture is wound. Above the carina are four subequal, strong spirals followed by the larger cord which is the keel of the earlier volution. All the spirals are wrinkled by oblique growth lines. Base with eight spirals somewhat flatter and broader than those of the spire. Aperture subquadrate. Outer lip strongly lirate within, the liræ corresponding to the external spirals. Pillar very short, with one strong, lamellar-like tooth. Callus on inner lip thin. Shell imperforate. Altitude of adult specimen when entire, about 20 mm., greatest diameter 19 mm.

This species is nearest to *Modulus willcoxi* Dall, from the Miocene of Florida; but is proportionately broader, and has a single, instead of a duplex keel. *Modulus basileus* (*Monodonta basilea* Guppy, Geol. Mag., 1874, p. 434, pl. 6, fig. 2) from the Jamaican Miocene is tuberculate. *M. turbinatus* Heilprin is entirely unlike—the spire having strong, oblique waves and no spirals.

Localities.—Machapoorie quarry; Guaico-Tamana road at the 13th mile post.

Horizon.—Machapoorie Miocene.

Genus *NATICA* Scopoli

Natica canrena (Linnæus) Moersch

Pl. 40, Fig. 8

Nerita canrena (Linnæus *pars*) Auct., Moersch, 1877, Malak. Blatt., 24, p. 62.

Natica canrena Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 156; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 35.

Natica canrena Gabb, 1873, Trans. Amer. Phil. Soc., vol. 15, p. 223.

Natica canrena Guppy, 1874, Geol. Mag., London, p. 437; 1876, Quart. Jour. Geol. Soc. London, vol. 32, p. 518.

Natica canrena Dall, 1892, Trans. Wagner Inst. Sci., vol. 3, p. 364.

Natica canrena Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, pp. 6, 11; *Idem*, Paper No. 454, p. 5; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, pp. 148, 153, 162.

Natica canrena Maury, 1917, Bull. Amer. Paleont., No. 29, p. 134, pl. 23, fig. 10; 1920, Sci. Surv. Porto Rico and the Virgin Isls., vol. 3, pt. 1, p. 48; 1922, Bull. Amer. Paleont., No. 38, p. 117.

Natica canrena Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 155, pl. 13, fig. 9.

This ancient, static species, is quickly recognized by the tangential plicæ adjoining the suture, the surface elsewhere being smooth. A good sized Trinidad specimen measures in height 35, width 31 mm.

N. canrena is found in the Miocene of Florida, N. Carolina, Jamaica, Porto Rico, Dominican Republic, and Panama. Its present range is from Hatteras to Pernambuco and throughout the Antilles.

Locality.—Springvale.

Horizon.—Upper Miocene.

***Natica youngi* Maury**

Pl. 40, Fig 4

Natica Youngi Maury, 1917, Bull. Amer. Paleont., No. 29, p. 135, pl. 23, figs. 11, 12.

Natica youngi Vaughan and Woodring, 1921, Geol. Recon. Dominican Republic, p. 143.

On comparing the Trinidad specimens with my Dominican types of *Natica youngi* they were seen to correspond perfectly. The shell is subglobose, with the suture well-defined, and the surface smooth, except for fine growth lines. A large Trinidad shell is 25 mm. in height and 24 in width.

This is a descendant of the Eocene *N. permunda* Conrad. *Natica youngi* is present in both the Gurabo and Cercado formations, Dominican Republic; and Mr. Olsson has described variety *cocleana* from the Gatun stage of Costa Rica.

Locality.—Springvale.

Horizon.—Upper Miocene.

***Natica cuspidata* Guppy**

Pl. 40, Figs. 9, 10

Natica cuspidata Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 454, p. 5, pl. 2, fig. 4; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 162, pl. 8, fig. 4.

Shell large, moderately thick, somewhat depressed, being *Sigaretus*-like in general form. Surface smooth except for growth lines. Callus heavy, large, with a well

marked transverse groove dividing it into nearly equal portions. Our largest specimen is 45 mm. in height and 55 in width. Guppy type was 60 x 70. It was obtained from the same place as our specimens.

Locality.—Springvale.

Horizon.—Upper Miocene.

***Natica perlineata* Dall**

Natica perlineata Dall, 1889, Blake Report, Gastr., p. 294.

Natica perlineata Guppy and Dall, 1896, Proc. U. S. Nat. Mus., vol. 19, p. 322.

Recent in the Antilles. Fossil in the Miocene of Montserrat. (Guppy and Dall.)

Genus *POLINICES* Montfort

***Polinices stanislas-meunieri* Maury**

Pl. 40, Fig. 7

Polinices Stanislas-Meunieri Maury, 1917, Bull. Amer. Paleont., No. 29, p. 136, pl. 23, figs. 15, 16.

Polinices Stanislas-Meunieri Olsson, 1922, Bull. Amer. Paleont., No. 39, p. 157, pl. 13, fig. 7.

Many of our Trinidad shells seem to agree in all respects with the Dominican types of *stanislas-meunieri*. This species is larger than *subclausa* Sowerby; but relatively thinner, with a higher spire.

A large Trinidad shell measures 39 in height and 30 in diameter; a medium-sized specimen is 33 x 24, the type was 36 x 28 mm.

The type locality was along Rio Cana, Dominican Republic. A Costa Rican shell, 43 x 35 mm., seems typical except in being unusually large.

Locality.—Springvale.

Horizon.—Upper Miocene.

***Polinices caparona*, n. sp.**

Pl. 40, Fig. 5

Shell large, ovate, resembling in general form *Polinices stanislas-meunieri* Maury, but of larger size than typical; and differing markedly in the conspicuous concavely

excavated subsutural zone. Height 48, diameter 37 mm.

Locality.—11th mile post on Caparo Road.

Horizon.—Manzanilla Miocene.

***Polinices springvalensis*, n. sp.**

Pl. 40, Fig. 6

Shell rather large, rotund, differing from *Polinices stanislas-meunieri* in the very conspicuous shouldering of the whorls. Beneath the suture of each whorl is a little shelf which gives a squarish aspect, quite unlike the evenly and gently rounded contours of *P. stanislas-meunieri*. Height 40, diameter 31 mm.

Locality.—Springvale.

Horizon.—Upper Miocene.

Genus *EPITONIUM* Bolten

***Epitonium* (?) *leroyi* Guppy**

Pl. 41, Figs. 8, 11

Scalaria leroyi Guppy, 1867, Proc. Sci. Assoc. Trinidad, p. 168; Harris' Reprint, 1921, Bull. Amer. Paleont., No 35, p. 47.

Not *Scalaria leroyi* Guppy, 1874, Geol. Mag., London, p. 406, pl. 16, fig. 10 (Jamaica specimen), nor pl. 18, fig. 2 (Trinidad mold of a different shell).

Scalaria leroyi Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper No. 440, p. 7; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 47.

We have a number of curious molds which are certainly the same as those Dr. Guppy found at Springvale, and in all probability the same as the large molds, "from the Caroni series Savanetta," which constituted the type of his *Scalaria leroyi*. But the illustration of what he thought a small mold of the same species, and figured in the Geological Magazine, 1874, pl. 18, fig. 2, is of something else, and must be entirely rejected.

These molds are of a turreted shell with very convex whorls and a deeply impressed suture. The whorls show only here and there a few spiral threads, and at the base of the body whorl there are one or two strong spirals. But the striking character is that nearly the entire surface of the volutions is dented and faucetted from the attachment of

foreign particles, some of which have left imprints of sculpture and were evidently shell fragments. Most of our specimens measure about 40 x 11 mm., but one has a diameter of 22 mm. All are fragmentary and the complete shell was large, for, *fide* Guppy, the molds may attain six inches in length.

I have never seen or heard of an *Epitonium* with the agglutinative habit, similar to that of *Xenophora agglutinans*, which these molds certainly indicate. Moreover, the characteristic sculpture of *Epitonium* is not shown. The generic position of the molds is very doubtful and they are left in *Epitonium* because one is puzzled to know in what genus they would more truly be placed.

Locality.—Springvale.

Horizon.—Upper Miocene.

***Epitonium (Acrilla) pseudoleroyi*, n. sp.**

Scalaria leroyi Guppy, 1874, Geol. Mag., London, p. 406, pl. 16, fig. 10.
Not pl. 18, fig. 2.

Not *Scalaria leroyi* Guppy, 1867, Proc. Sci. Assoc. Trinidad, p. 168;
Harris' Reprint, Bull. Amer. Paleont., No. 35, p. 47.

Scala (Acrilla) leroyi Guppy and Dall, 1896, Proc. U. S. Nat. Mus.,
vol. 19, No. 1110, p. 328.

Scalaria leroyi Guppy, 1910, Agr. Soc. Trinidad and Tobago, Paper
No. 440, p. 7; Harris Reprint, 1921, Bull. 35, p. 47.

The original description of Guppy's *Scalaria leroyi*, in 1867, was based on molds from Trinidad. These are entirely unlike the Jamaican cancellated shell described by Dr. Guppy in 1874, in the Geological Magazine, page 406, and figured pl. 12, fig. 10, as *Scalaria leroyi*.

For this Jamaican species the name *pseudoleroyi* would seem appropriate.

Locality.—Jamaica.

Horizon.—Miocene.

***Epitonium (Cirsotrema) tamanensis*, n. sp.**

Pl. 37, Fig. 4

We have a single broken and worn *Epitonium* that appears to belong to the group of *E. cochlea* Sowerby, of

the recent Mediterranean and Antillean faunas, but of much larger size. The specimen shows only the last whorl, which is sculptured with very closely-set, very thin lamellæ, and bears at intervals heavy, rounded varices. The whorl is very strongly carinate above and greatly flattened, forming a wide, flat shoulder, as in *cochlea*. Aperture rounded, surface decorticate. Height of last whorl 20, greatest width 17 mm.

Locality.— $13\frac{1}{8}$ miles on Cunapo Southern Road.

Horizon.—Tamana Miocene.

Genus *CALYPTRÆA* Lamarck

Calyptrea centralis Conrad

Pl. 43, Fig. 2

Infundibulum centralis Conrad, 1841, Amer. Jour. Sci., vol. 41, p. 348.
Infundibulum Candearna d'Orbigny, 1842, Moll. Cuba 2, p. 190, pl. 24, figs. 28, 29.

Calyptrea centralis Dall, 1892, Trans. Wagner Inst. Sci., vol. 3, p. 353.
Calyptrea centralis Maury, 1912, Jour. Acad. Nat. Sci. Phila., 2d ser., vol. 15, p. 100, pl. 13, fig. 6.

An ancient species, ranging from Lower Miocene to Recent, and extending from Cape Hatteras almost to the Straits of Magellan.

Our largest Trinidad shell measures 15 mm. in diameter.

Localities.—Southern main road, just south of Pitch Lake, Brighton; Matura.

Horizons.—Upper Miocene; Pliocene.

Genus *CREPIDULA* Lamarck

Crepidula aculeata Gmelin

Patella aculeata Gmelin, 1788, Syst. Nat., p. 3693.

Crepidula aculeata Guppy, 1864, Trans. Sci. Assoc. Trinidad, p. 35; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 15.

Crepidula aculeata Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, p. 160; Harris' Reprint, 1921, Bull. 35, p. 39.

Crepidula aculeata Guppy, 1874, Geol. Mag., London, p. 441.

Crepidula aculeata Tryon, 1886, Man. Conch., vol. 8, p. 129, pl. 39, figs. 61, 62.

Crepidula aculeata Dall, 1889, Bull. U. S. Nat. Mus., No. 37, p. 152.

Crepidula aculeata Maury, 1922, Bull. Amer. Paleont., No. 38, p. 114.

Comparison of Trinidad fossil specimens with recent Florida shells of *C. aculeata* shows a perfect similarity.

When the surface is not worn, this species has narrow, radiating riblets bearing short, prickly spines. Length of largest fossil shell 25, greatest width 18 mm. The typical form appeared in the Pliocene of Florida and is now living on the east coast from Lat. 35° N. to Lat. 35° S., and on the west coast from California to Chile.

Locality.—Matura.

Horizon.—Upper Pliocene.

***Crepidula fornicata* Linnæus**

Patella fornicata Linnæus, 1767, Syst. Nat., ed. 12, vol. 1, p. 1257.

Crepidula fornicata Gould, 1870, Invert. Mass., p. 271, fig. 532.

Crepidula fornicata Dall, 1889, Bull. 37, U. S. Nat. Mus., p. 152, pl. 48, fig. 16, pl. 50, figs. 23, 24; 1892, Trans. Wagner Inst. Sci., vol. 3, p. 356.

In the collection is a young shell, and a larger imperfect specimen, resembling recent examples of *C. fornicata* from Florida. But the identification is not certain because the interior of the fossils is concealed by the matrix.

This species is boat-shaped, arched, convex, with half of the cavity floored over. The degree of convexity varies with the nature of the object to which the shell is attached.

C. fornicata first appeared in the Chipolan Miocene of Florida, and is now living along the Atlantic coast to Cartagena, Colombia, and through the Antilles.

Locality.—Springvale.

Horizon.—Upper Miocene.

Genus *CALLIOSTOMA* Swainson

***Calliostoma decipiens* Guppy**

Pl. 43, Fig. 9

Trochus decipiens Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, pp. 161, 172; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, pp. 40, 51.

Trochus decipiens Guppy, 1874, Geol. Mag., London, p. 435, pl. 18, fig. 18.

Shell conic, imperforate, with about seven whorls, the first two nuclear, smooth, porcellaneous. Later whorls

angulated near their lower margins, slightly concave above, and ornamented with rows of granules that tend to alternate in strength. Aperture squarish, wider than high. Columella covered with a callus. Altitude 14, greatest diameter 15 mm.

This species is a member of the group of *Calliostoma philanthropus* Conrad, of the Maryland Miocene, and *C. euglyptum* A. Adams, of the Recent fauna. It is at once distinguished from the associated species, *C. plicomphalus* Guppy, by its imperforate shell and carinated whorls.

Locality.—Matura.

Horizon.—Upper Pliocene.

***Calliostoma decipiens* var. *laticarinatum* Guppy** Pl. 43, Figs. 5, 10

Trochus granulatus Guppy, 1864, Trans. Sci. Assoc. Trinidad, p. 35; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, p. 15. Not *granulatus* Born.

Trochus decipiens var. *laticarinatus* Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, pp. 161, 172; Harris' Reprint, 1921, Bull. 35, pp. 40, 51.

Trochus decipiens var. *laticarinatus* Guppy, 1874, Geol. Mag., London, p. 435, pl. 18, fig. 19.

This variety is more strongly keeled than the typical form, with the whorls above the carination more concavely excavated. As in the typical *decipiens*, the two whorls following the nuclear, are not only striate but also very delicately, longitudinally ribbed, forming a dainty, microscopic cancellation. Later whorls ornamented only with the granular spiral striæ which generally alternate in strength. Altitude 12, greatest diameter 14 mm. In form this is not unlike *C. philanthropus* var. *eliminatum* Dall, but differs in sculpture from that Cape Fear River, Miocene shell.

Locality.—Matura.

Horizon.—Upper Pliocene.

***Calliostoma caronianum*, n. sp.**

Pl. 43, Fig. 8

Shell of moderate size, imperforate, with about eight whorls, the first two nuclear. Later volutions with a carination at the lower third, above which there is an excavated

zone extending to the suture. The entire surface is sculptured with very numerous, very fine, subequal, beaded threads often with crenate striæ between them. On the base the revolving threads are coarser centrally and are crenated by growth lines. Towards the margin the spirals become as fine as those on the upper surface of the shell. Basal periphery roundly carinate. Altitude 16, greatest diameter 16 mm.

This differs from the Pliocene *C. decipiens* in being much more closely and finely spirally sculptured, and in its carinated whorls. From *decipiens* var. *laticarinatum*, it differs in its much greater altitude and in the form of the whorls above the carination.

Like *C. decipiens*, *C. caronianum* is a member of the group of *C. philanthropus*, and in form and general type of sculpture resembles *C. conradianum* Dall (perhaps a variety of *philanthropus*), but is less than half the size of that splendid shell.

Locality.—Springvale.

Horizon.—Upper Miocene.

Section *EUTROCHUS* A. Adams

Calliostoma (Eutrochus) plicomphalus Guppy Pl. 43, Figs. 11, 13, 15

Trochus plicomphalus Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, pp. 161, 173; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, pp. 40, 52.

Trochus plicomphalus Guppy, 1874, Geol. Mag., London, p. 435, pl. 18, fig. 17.

Shell large, very broadly conic, the diameter being greater than the height, with about eight whorls, very deeply circularly perforate, the perforation bordered by a coarsely beaded thread. The sculpture is of closely-set, spiral granular lines, frequently alternating in strength. Aperture subquadrate. Columella nearly straight. Our largest shell is 20 mm. in altitude and 25 in greatest diameter. A smaller one measures 13 x 15 mm.

This species is very close to the recent *C. jujubinum*

var. *perspectivum* (Koch) Philippi (= *tampænsis* Conrad) which is living from Cape Hatteras to Honduras but the Trinidad fossil is broader. As Dr. Guppy said, it has much the general form of the Mediterranean *C. zizyphinum* Linnaeus, but is not keeled.

Locality.—Matura.

Horizon.—Upper Pliocene.

Calliostoma (Eutrochus) olssoni, n. sp.

Pl. 43, Fig. 6, 14

Shell small, broadly conic, about five-whorled, low, perforate; body whorl carinate; suture deeply channelled and bordered beneath by a handsome row of large beads. Elsewhere the sculpture is of spiral rows of much finer granules, often alternating with still finer granose striæ. On both the penultimate whorl, and on the last volution above the carina, there are about five spirals, each set capped by its row of beads. The carina is a smooth spiral cord and all the spirals on the under surface of the shell are smooth, except the two or three nearest to the perforation which are granose. Aperture strongly angled by the basal carina. Altitude of largest shell 7, greatest diameter 13 mm. The smaller measures 4.5 x 7 mm.

A most attractive species, distinguished from the associated Calliostomas by its flattened form and the row of large beads bordering the suture. It is dedicated to Mr. Axel Olsson.

Locality.—Matura.

Horizon.—Upper Miocene.

Genus *DILLWYNELLA* Dall

Dillwynella errata Guppy

Dillwynella errata Guppy, 1896, Proc. U. S. Nat. Mus., vol. 19, p. 323, pl. 27, fig. 2.

Cadulus bed, Pointe-à-Pierre (Guppy).

Horizon.—Miocene.

Genus *SOLARIELLA* S. Wood*Solariella caroniana*, n. sp.

Pl. 43, Figs. 7, 12

Shell small, conic, with about five volutions. General form of whorls rounded, but beneath the suture they are strongly flattened and shouldered. Each shoulder is edged by a spiral thread, finely and daintily beaded. On the body whorl, a spiral of equal strength, but not beaded, borders the periphery, and equidistant between it and the shoulder spiral are a pair of much finer spirals. Beneath the rounded periphery are two major spirals and many very fine threads. The very deep, circular perforation is bordered by a coarse, crenate thread. The entire surface of the upper part of the shell is marked with raised, oblique threads in harmony with the direction of growth. These lines at their intersection with the shoulder spirals produce the beading. Height of shell 7, greatest diameter 7 mm.

This species resembles *Solariella altiuscula* Guppy (Proc. U. S. Nat. Mus., vol. 19, pl. 27, fig. 17, 1896) from the Jamaican Miocene; but that is more strongly spirally sculptured and lacks the beading on the carinæ.

Locality.—Springvale.

Horizon.—Upper Miocene.

Solariella (?) *semidecussata* Guppy

Solarium semidecussatum Guppy, 1867, Proc. Sci. Assoc. Trinidad, pt. 3, pp. 156, 170; Harris' Reprint, 1921, Bull. Amer. Paleont., No. 35, pp. 35, 49.

Solarium semidecussatum Guppy, 1874, Geol. Mag., London, p. 408, pl. 18, fig. 14.

Solarium semidecussatum Dall, 1892, Trans. Wagner Inst. Sci., vol. 3, p. 407.

Fide Dr. Dall, this species is probably a *Solariella*. Guppy's description sounds like it, but is inadequate and the figure is poor. The shell is small, orbicular, depressed, strongly decussate on the upper surface, nearly smooth beneath. Perforation deep, crenate on the margin.

Locality.—Matura (Guppy).

Horizon.—Upper Pliocene.

Genus *TEINOSTOMA* A. Adams

Teinostoma caroniense, n. sp.

Pl. 43, Figs. 3, 4

Shell very small, imperforate, polished and shining. Spire flattened, suture distinct, impressed; whorls five, the first two minute, nuclear. Body whorl convexly rounded. Callus covering the umbilical region somewhat crescent-shaped. The surface of the shell appears entirely smooth; but under a compound microscope faint growth lines are seen, and on the last volution extremely fine, incised spiral striæ. On the third whorl, these are very delicately cancellated by the growth lines, but this is seen only with high magnification. The greatest diameter of the larger specimen is 4.5, altitude 2.20 mm.

This species differs from *Teinostoma sandomingense* Maury, from the Dominican Miocene in the following respects: The callus in the Dominican shell is larger and spreads circularly over the umbilicus, while in the Trinidad shell it is like a plug pushed in, and continuous with the callosity of the lip; the surface of the Dominican shell shows no spirals even under the compound microscope; and the body whorl is flattened and somewhat excavated beneath the suture which is not the case in the Trinidad shell. *Teinostoma angulatum* Gabb, has very much fainter spirals. *T. depressum* Gabb is entirely smooth, and *vitreum* Gabb, has only $3\frac{3}{4}$ whorls and is less than half the size of *caroniense*.

Locality.—Springvale.

Horizon.—Upper Miocene.

Genus *FISSURIDEA* Swainson

Fissuridea alternata Say

Pl. 43, Fig. 1

Fissurella alternata Say, 1822, Jour. Acad. Nat. Sci. Phila., vol. 2, p. 281.

Fissuridea alternata Dall, 1892, Trans. Wagner Inst. Sci., vol. 3,

p. 428.

Fissuridea alternata Maury, 1917, Bull. Amer. Paleont., No. 29, p. 157,
pl. 24, fig. 22.

Fissuridea alternata Maury, 1922, Bull. Amer. Paleont., No. 38, p. 136.

In addition to the alternation in size of the riblets, every fourth ray tends to be larger, as is often the case in the recent specimens. Probably our Trinidad specimens are stunted examples of this species, which appeared first in the Dominican Miocene, and ranges now from Cape Hatteras to Brazil.

Locality.—Matura.

Horizon.—Pliocene.

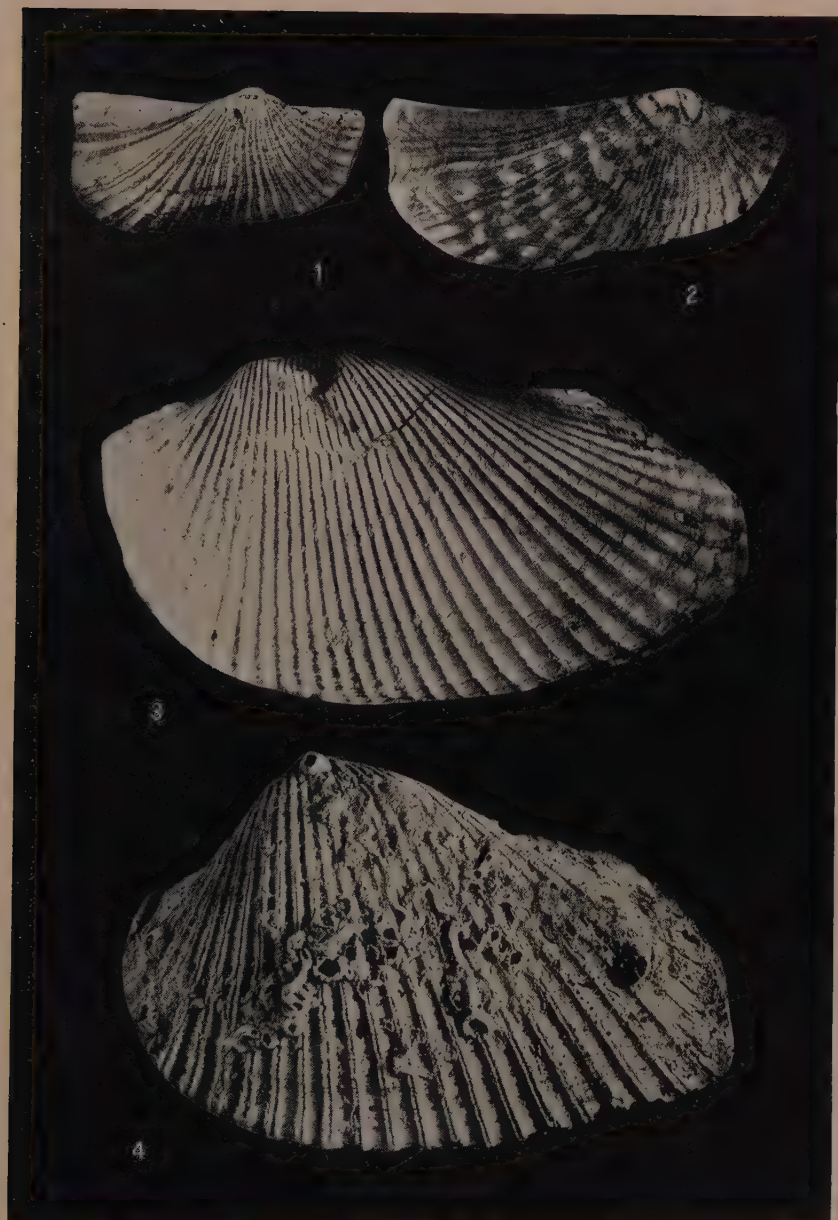
PLATES

Photo's by G. D. Harris
Halftn's by the Ithaca Engraving Company

EXPLANATION OF PLATE 1

Figure		Page
1.	<i>Arca occidentalis</i> Philippi. Matura -----	34
2.	<i>Arca occidentalis</i> Philippi. Sans Souci Bay -----	34
3.	<i>Arca</i> (<i>Scapharca</i>) <i>thauuma</i> , n. sp. 98 mm. Springvale-----	62
4.	<i>Arca</i> (<i>Scapharca</i>) <i>secticostata</i> Reeve. Mosquito Creek coast -----	47

Figures are natural size unless the dimensions are given.



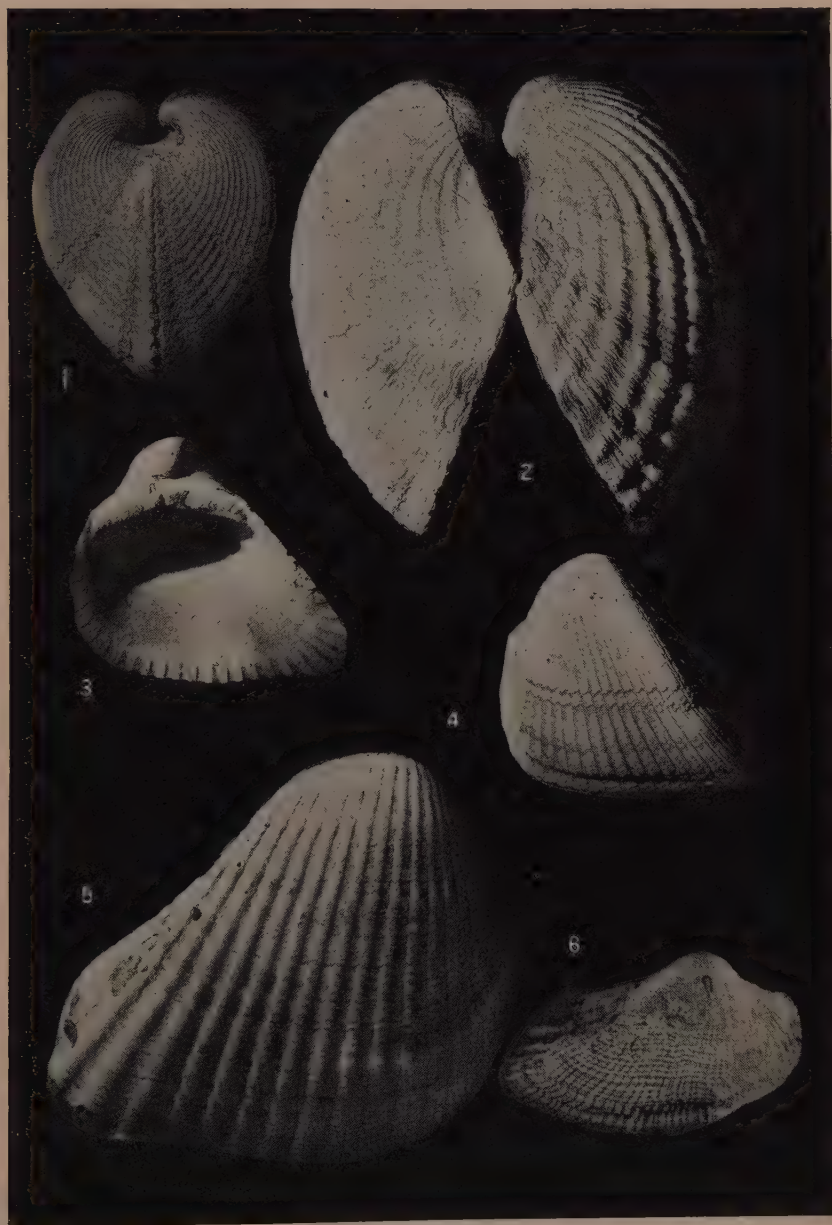
EXPLANATION OF PLATE 2

Figure	Page
1. <i>Arca (Scapharca) chiriquiensis</i> var. <i>stamineopsis</i> , n. var. North of Manzanilla Point 33 mm.-----	60
2. <i>Arca (Scapharca) chiriquiensis</i> Gabb. Dominican Republic	59
3. <i>Arca (Scapharca) promentoriana</i> , n. sp. 600 feet N. of Point Noir-----	
4. <i>Arca (Scapharca) chiriquiensis</i> var. <i>carolinoides</i> , n. var. 26 mm.-----	60
5. <i>Arca (Scapharca) patricia</i> Sowerby. Near Todd's R. R. Station -----	57



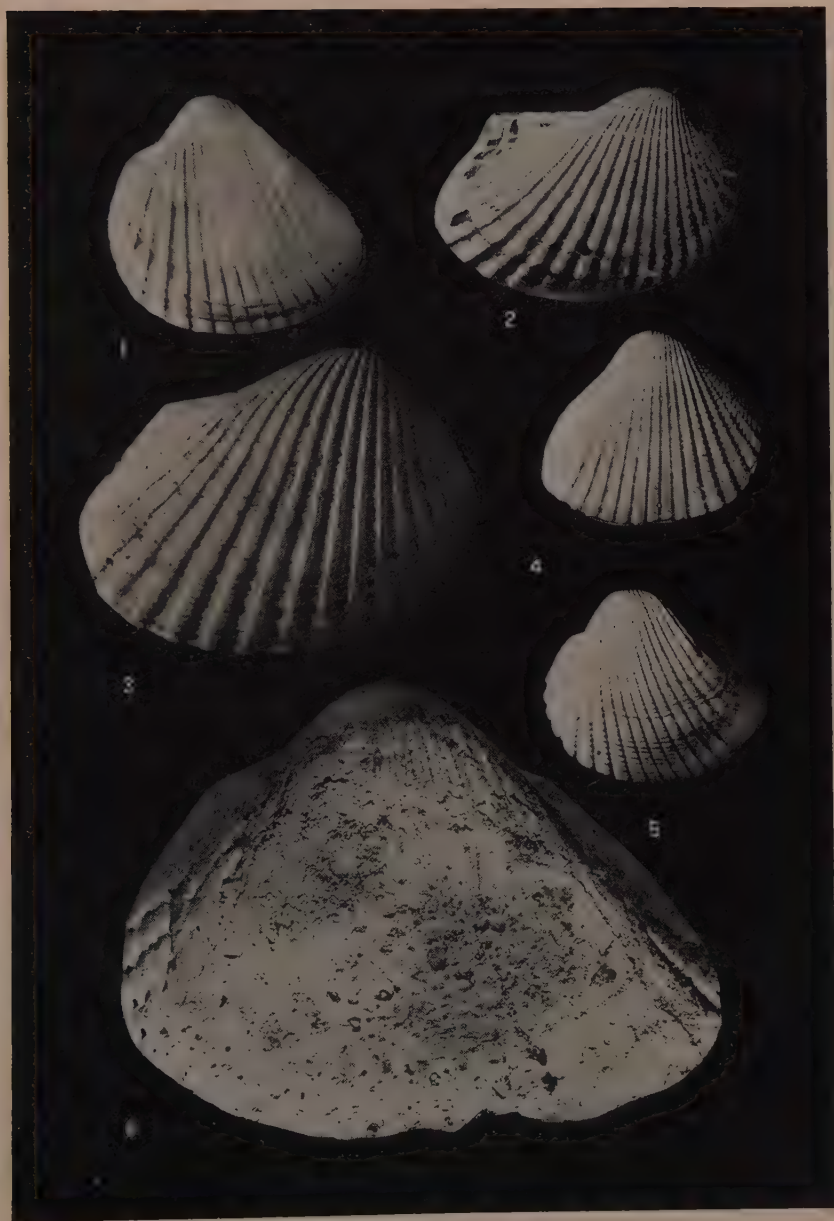
EXPLANATION OF PLATE 3

Figure		Page
1.	<i>Arca</i> (<i>Noëtia</i>) <i>trinitaria</i> Guppy. Diam. 20 mm. Manzanilla Point -----	35
2.	<i>Arca</i> (<i>Scapharca</i>) <i>patricia</i> var. <i>waringi</i> , n. var. Both valves. Headland N. of Manzanilla Point -----	58
3.	<i>Arca</i> (<i>Noëtia</i>) <i>trinitaria</i> Guppy. Interior. 24 mm. Manzanilla Point -----	35
4.	<i>Arca</i> (<i>Noëtia</i>) <i>trinitaria</i> Guppy. 25 mm. Manzanilla Point. --	35
5.	<i>Arca</i> (<i>Scapharca</i>) <i>patricia</i> var. <i>waringi</i> , n. var. Headland North of Manzanilla Point -----	58
6.	<i>Arca umbonata</i> Lamarck. Recent -----	35



EXPLANATION OF PLATE 4

Figure		Page
1.	<i>Arca (Cunearca) brasiliiana</i> Lamarck. Recent. Trinidad----	66
2.	<i>Arca (Scapharca) auriculata</i> Lamarck. Erin Point-----	49
3.	<i>Arca (Scapharca) deshayesi</i> Lamarck. Recent. Guadeloupe	49
4.	<i>Arca (Cunearca) brasiliiana</i> Lamarck. Right valve. Trinidad	66
5.	<i>Arca (Cunearca) brasiliiana</i> Lamarck. Left valve. Trinidad	66
6.	<i>Arca (Scapharca) oropuchensis</i> , n. sp. South of the mouth of Oropuche River -----	63



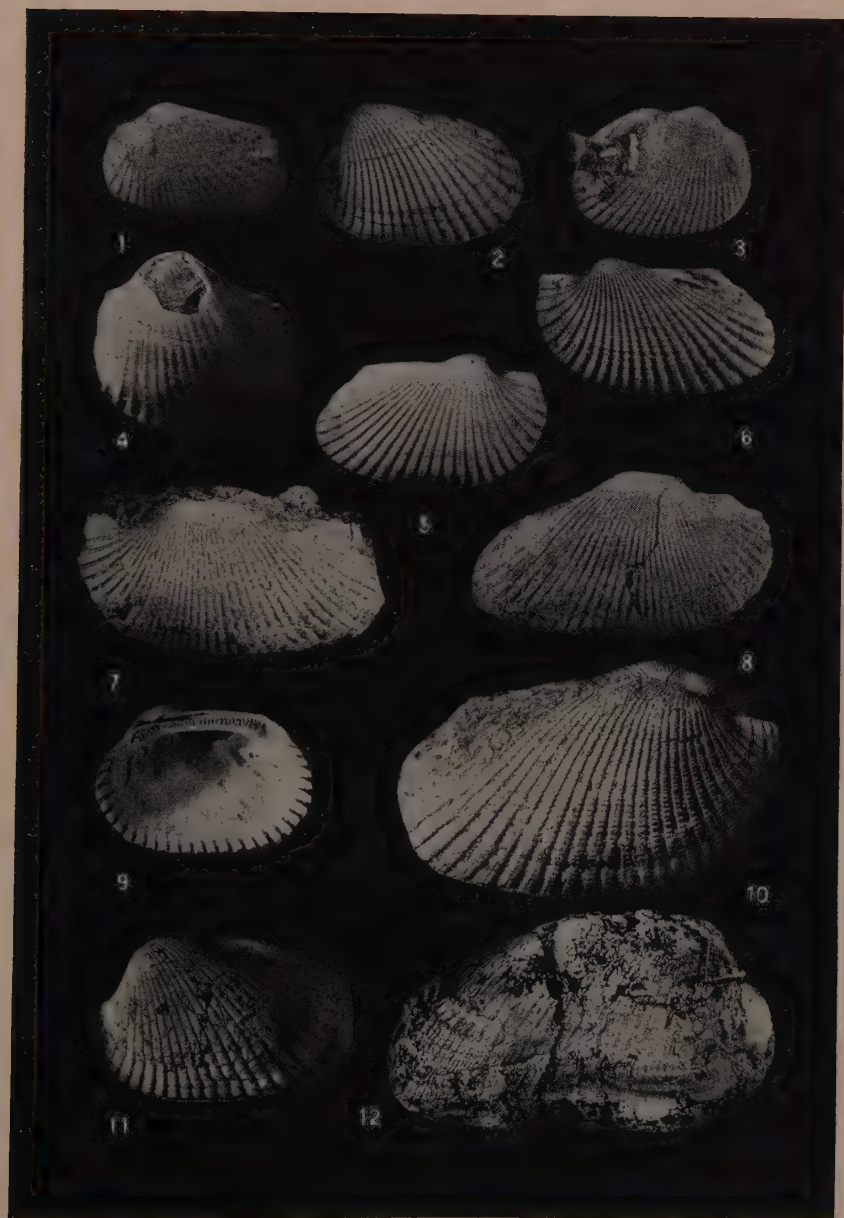
EXPLANATION OF PLATE 5

Figure		Page
1.	<i>Arca (Argina) billingsiana</i> var. <i>schultzana</i> Maury. Type. Brighton -----	77
2.	<i>Arca (Noëtia) mayensis</i> , n. 26 mm. Junction Mayo and Couva main roads -----	40
3.	<i>Arca (Argina) billingsiana</i> var. <i>maturensis</i> , n. var. 39 mm. Matura -----	78
4.	<i>Arca (Cunearca) cumanensis</i> Dall. Island, Lake Henriquillo, Dominician Republic -----	70
5.	<i>Arca (Noëtia) mundonuevensis</i> , n. sp. Junction Mayo and Couva main roads -----	36
6.	<i>Arca (Cunearca) sancti-andreæ</i> , n. 24 mm. Matura -----	67
7.	<i>Arca (Noëtia) mundonuevensis</i> , n. sp. Smaller specimen than Fig. 5. 28 mm. Junction Mayo and Couva main roads -----	36
8.	<i>Arca (Scapharca) halidonata</i> Dall. Bowden, Jamaica -----	48



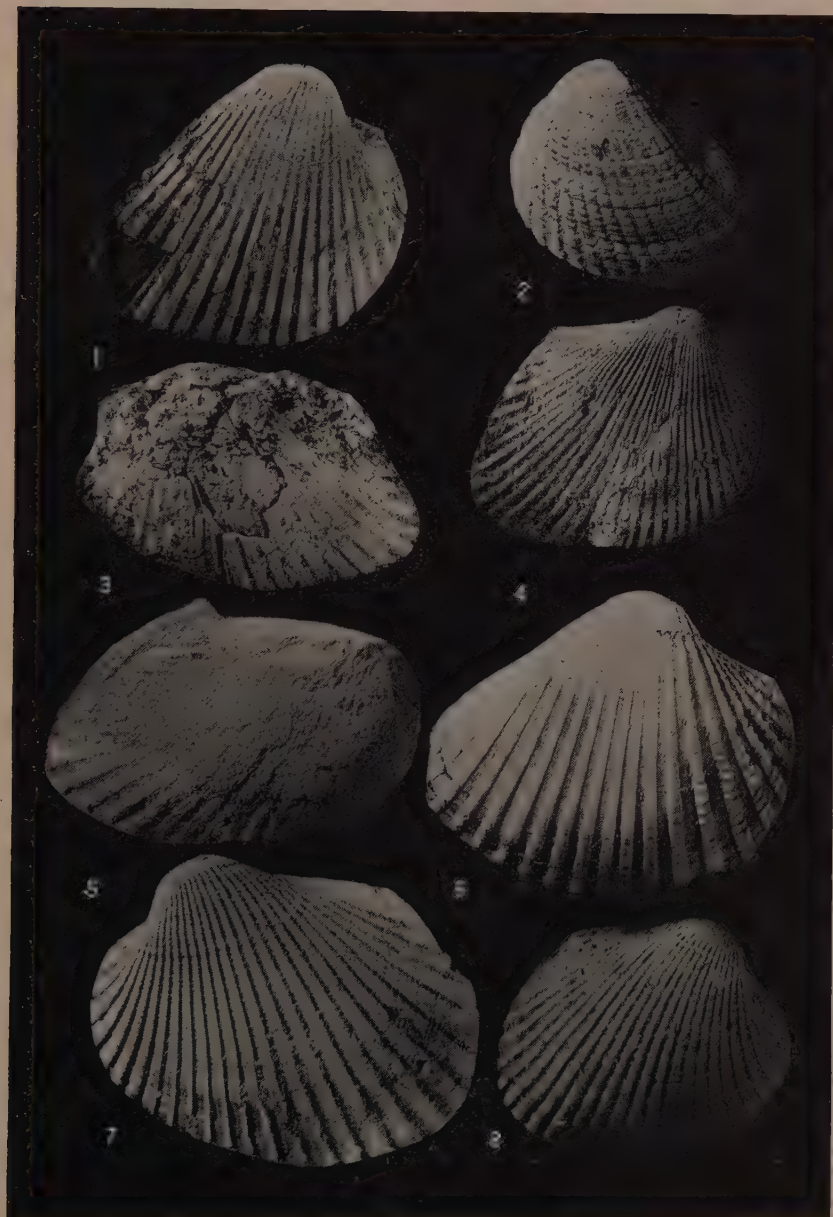
EXPLANATION OF PLATE 6

Figure		Page
1.	<i>Arca (Cunearca) esperanza</i> , n. sp. Brasso Junction quarry--	64
2.	<i>Arca (Argina) billingsiana</i> Maury. Type. Brighton-----	76
3.	<i>Arca (Scapharca) transversa</i> var. <i>sancti-davidis</i> , n. var. 31 mm. Matura-----	64
4.	<i>Arca (Cunearca) sancti-blasii</i> , n. sp. St. Blaise Ravine. Cast. 25 mm.-----	71
5.	<i>Arca (Scapharca) dariensis</i> Brown and Pilsbry. 29 mm. Gatun-----	55
6.	<i>Arca (Scapharca) inæquilateralis</i> Guppy. Dominican Republic. 28mm-----	56
7.	<i>Arca (Scapharca) fontinalis</i> , n. sp. Left valve, 52 mm. Springvale-----	55
8.	<i>Arca (Scapharca) fontinalis</i> , n. sp. Right valve, 52 mm. Springvale-----	55
9.	<i>Arca (Argina) billingsiana</i> var. <i>maurensis</i> , n. var. Interior Matura-----	78
10.	<i>Arca (Scapharca) henekeni</i> Maury. 31 mm. Young shell. Machapoorie quarry-----	53
11.	<i>Arca (Argina) billingsiana</i> var. <i>maurensis</i> , n. var.. Matura	78
12.	<i>Arca (Cucullaria) perinopinata</i> , n. sp. 40 mm. Springvale--	46



EXPLANATION OF PLATE 7

Figure		Page
1.	<i>Arca</i> (<i>Scapharca</i>) <i>couræ</i> , n. sp. 54 mm. Right valve Springvale -----	51
2.	<i>Arca</i> (<i>Cunearca</i>) <i>tabaquita</i> var. <i>molesta</i> , n. var. 20 mm. 8½ mile post on the Tabaquite road -----	72
3.	<i>Arca</i> (<i>Scapharca</i>) <i>confugium</i> , n. sp. 58 mm. Springvale--	53
4.	<i>Arca</i> (<i>Scapharca</i>) <i>tectum-columbæ</i> , n. sp. Springvale-----	52
5.	<i>Arca</i> (<i>Scapharca</i>) <i>henekeni</i> var. <i>trinidadensis</i> , n. var. 41 mm. Southwest corner of E 25-----	54
6.	<i>Arca</i> (<i>Cunearca</i>) <i>incongrua</i> Say. For comparison with <i>brasiliana</i> -----	66
7.	<i>Arca</i> (<i>Argina</i>) <i>brightonensis</i> Maury. Type. 22 mm. Brighton	76
8.	<i>Arca</i> (<i>Argina</i>) <i>campechensis</i> Dillwyn. Megaro Bay 33 mm.	74



EXPLANATION OF PLATE 8

Figure		Page
1.	<i>Arca (Fossularca) adamsi</i> (Shuttleworth) Smith. 11 mm. Matura	45
2.	<i>Arca (Scapharca) pointnoirensis</i> , n. sp. 600 feet N. of Pointe Noir	61
3.	<i>Arca (Acar) milifolia</i> var. <i>latrinidensis</i> , n. var. 19 mm. Matura	44
4.	<i>Arca umbonata</i> Lamarck. Very young 11 mm.	35
5.	<i>Arca (Cunearca) filicata</i> Guppy. 14 mm. Manzanilla Point.	68
6.	<i>Arca (Barbatia) candida</i> Gmelin. Very young shell 10 mm. Matura	42
7.	<i>Arca (Scapharca) brassica</i> , n. sp. Half a mile above Brasso Station	56
8.	<i>Arca (Fossularca) adamsi</i> (Shuttleworth) Smith. 10 mm. Recent	45
9.	<i>Arca (Cunearca) sancti-blazii</i> , n. sp. Artificial cast. 17 mm. Saint Blaise Ravine	71
10.	<i>Arca (Noëtia) centrota</i> Guppy. Interior of left valve. 21 mm. Matura	38
11.	<i>Arca (Noëtia) sheldoniana</i> Maury. Type. 16 mm. Brighton	39
12.	<i>Arca (Noëtia) centrota</i> Guppy. Right valve. 21 mm. Matura	38
13.	<i>Arca (Noëtia) manzanillæ</i> , n. sp. Diameter 10 mm. Man- zanilla Point	41
14.	<i>Arca (Cunearca) tabaquita</i> , n. sp. 22 mm. 8½ mile post on the Tabaquite road	72
15.	<i>Arca (Cunearca) pittieri</i> var. <i>narivana</i> , n. var. Right valve Brasso Junction quarry	73
16.	<i>Arca (Scapharca) cuneareopsis</i> , n. sp. 600 feet North of Pointe Noir	62
17.	<i>Arca (Cunearca) pittieri</i> var. <i>narivana</i> , n. var. Left valve Brasso Junction quarry	73
18.	<i>Arca (Barbatia) reticulata</i> , n. sp. 11 mm. Recent Vene- zuela	43
19.	<i>Arca (Natia) manzanillæ</i> , n. sp. 11 mm. Manzanilla Point	41
20.	<i>Arca (Cunearca) pittieri</i> var. <i>narivana</i> , n. var. Young shell 19 mm. Half mile above Brasso Station	73
21.	<i>Arca (Barbatia) reticulata</i> Gmelin. 16 mm. Matura	43

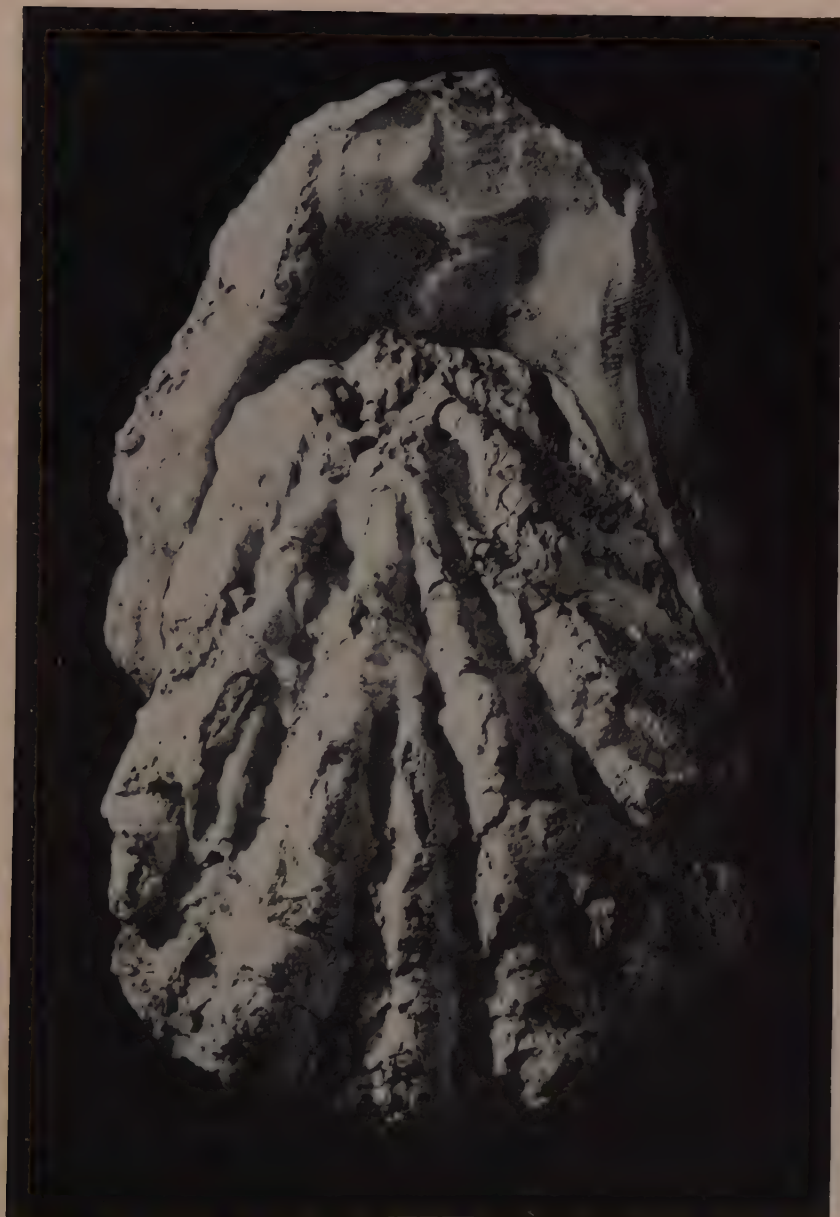


EXPLANATION OF PLATE 9

Figure

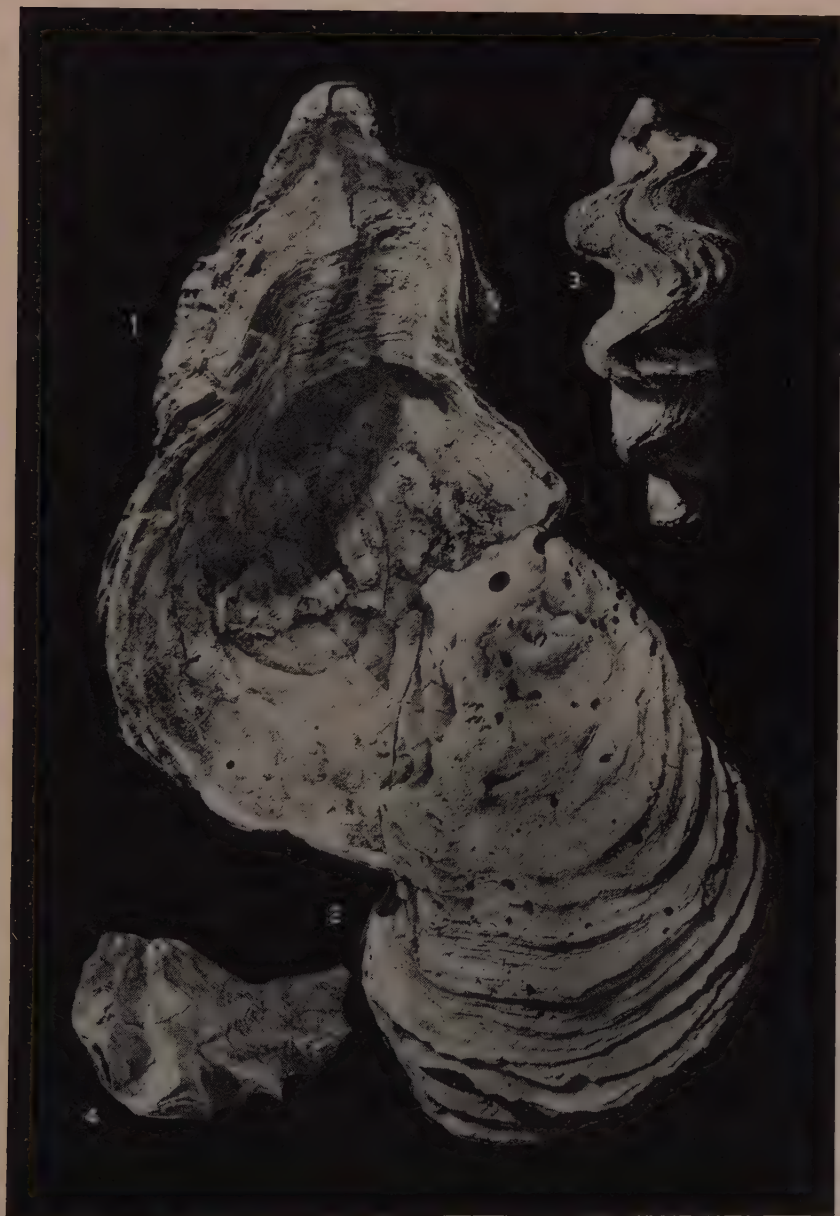
Page

- | | | |
|----|--|----|
| 1. | <i>Ostrea haitensis</i> Sowerby. Exterior and interior of the same valve. 92 mm. Springvale----- | 78 |
|----|--|----|



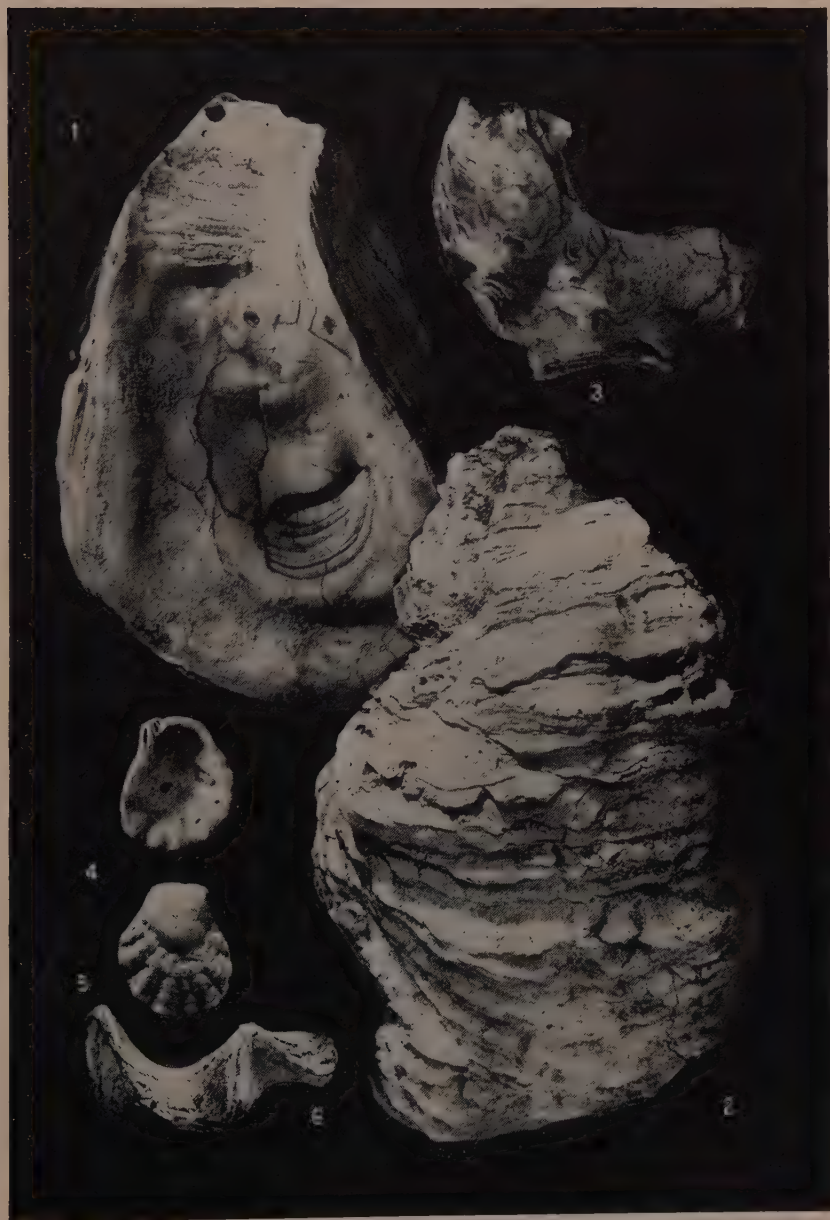
EXPLANATION OF PLATE 10

Figure		Page
1.	<i>Ostrea puelchana</i> d'Orbigny. Interior of convex valve. Ves- signy oil field, near Pitch Lake-----	79
2.	<i>Ostrea pulchana</i> d'Orbigny. Exterior of flat valve. Ves- signy oil field -----	79
3.	<i>Ostrea messor</i> , n. sp. 45 mm. Ventral aspect, Springvale----	81
4.	<i>Ostrea messor</i> , n. sp. Same specimen, lateral aspect. Springvale -----	81



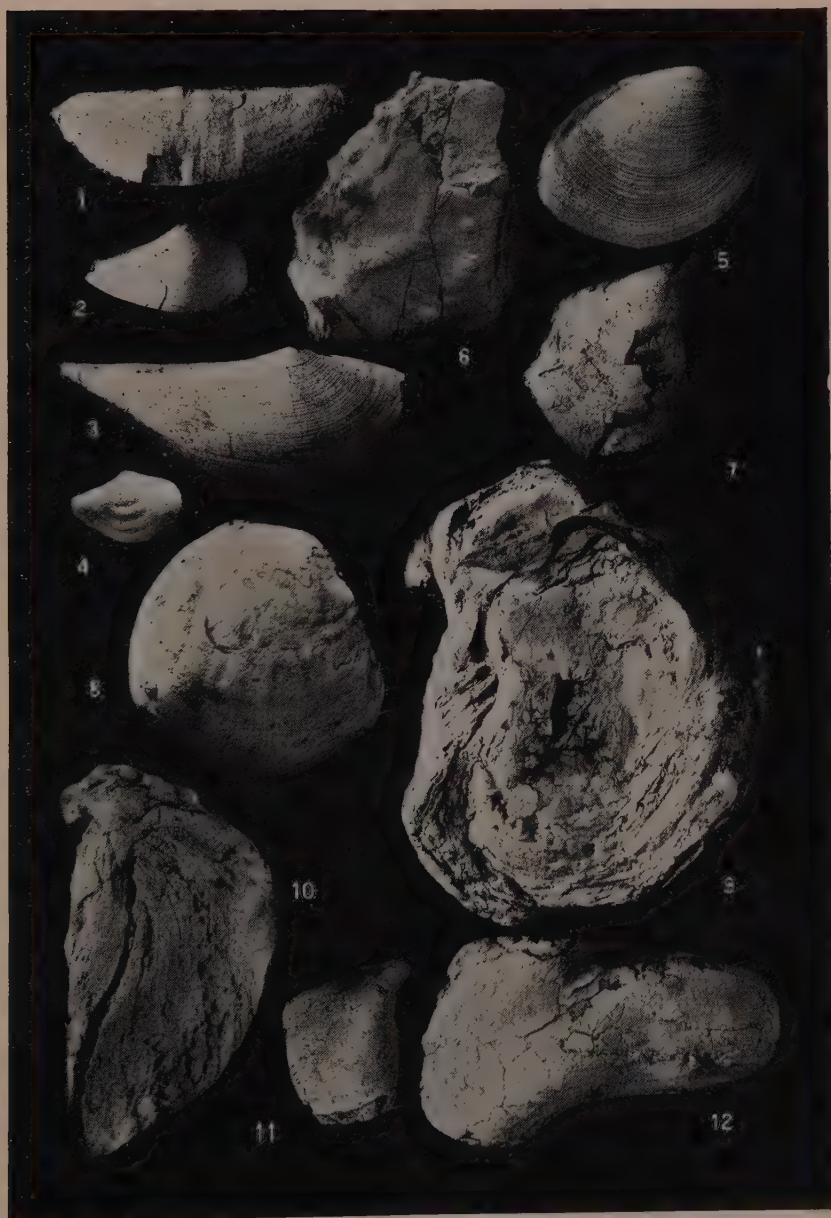
EXPLANATION OF PLATE 11

Figure		Page
1.	<i>Ostrea puelchana</i> d'Orbigny. Interior of flat valve. Vessigny oil field-----	79
2.	<i>Ostrea puelchana</i> d'Orbigny. Exterior of convex valve. Same specimen as shown on Plate 10. Vessigny oil field-----	79
3.	<i>Ostrea messor</i> var. <i>caimitica</i> , n. var. Domician Republic----	82
4.	<i>Plicatula gibbosa</i> Lamarck. Interior. Alt 14 mm. Matura---	91
5.	<i>Plicatula gibbosa</i> Lamarck. Exterior of same valve Matura	91
6.	<i>Ostrea messor</i> var. <i>tabaquita</i> n. var. Ventral aspect. 8½ mile post on the Tabaquite road-----	82



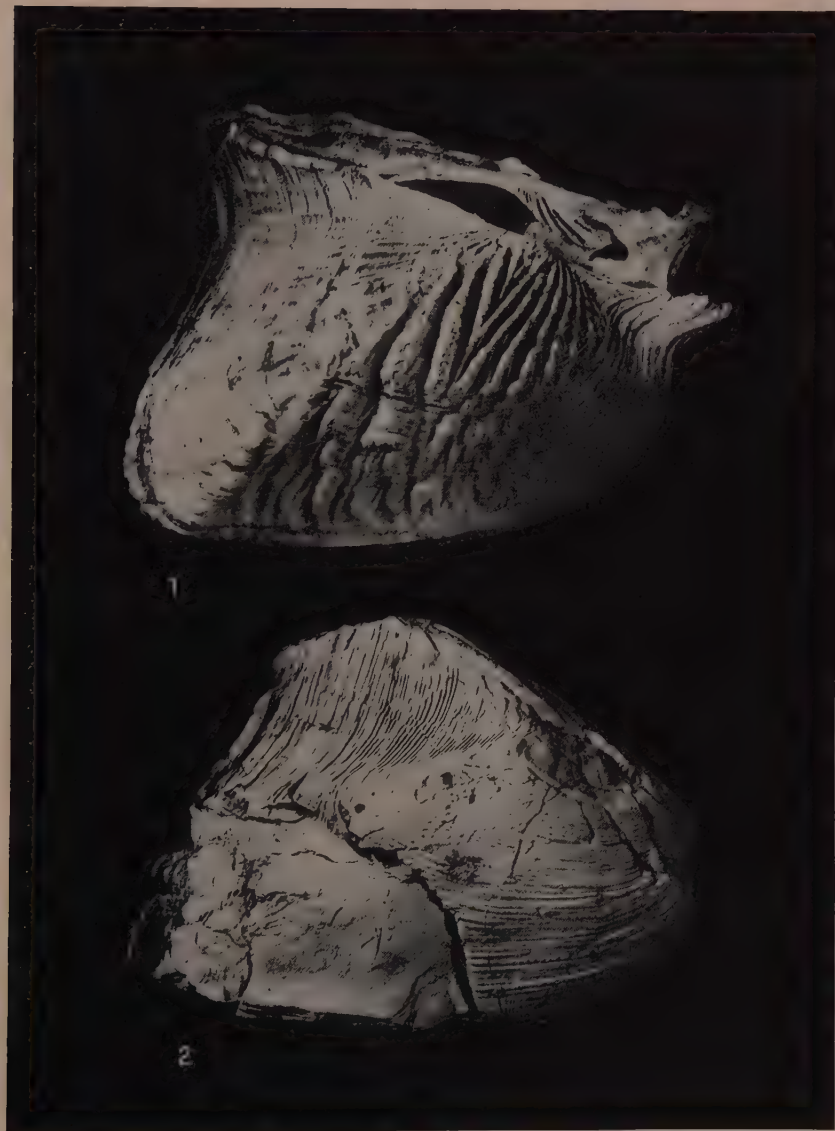
EXPLANATION OF PLATE 12

Figure		Page
1.	<i>Leda montserratensis</i> , n. sp. 18mm. Blue shaly clay, Brasso Junction -----	24
2.	<i>Leda illecta</i> Guppy. 12 mm. Manzanilla -----	22
3.	<i>Leda guppyi</i> Dall. 24 mm. Manzanilla -----	22
4.	<i>Leda perlepada</i> Guppy. 4 mm. Matura -----	26
5.	<i>Nucula baccata</i> Guppy. 7 mm. Matura -----	20
6.	<i>Ostrea messor</i> var. <i>tabaquita</i> ? Brasso Junction in blue clay -----	82
7.	<i>Mytilus caroniensis</i> , n. sp. 24 mm. Brasso Junction quarry -----	93
8.	<i>Anomia simplex</i> d'Orbigny. Alt. 26 mm. Matura -----	92
9.	<i>Ostrea pulchana</i> d'Orbigny. Small form. Near Manzanilla Point -----	79
10.	<i>Ostrea pulchana</i> d'Orbigny. Side view of same specimen --	79
11.	<i>Mytilus caroniensis</i> , n. sp. Alt. 19 mm. Brasso Junction quarry -----	93
12.	<i>Modiolus brassoensis</i> , n. sp. Length 41 mm. Brasso Junction quarry -----	94



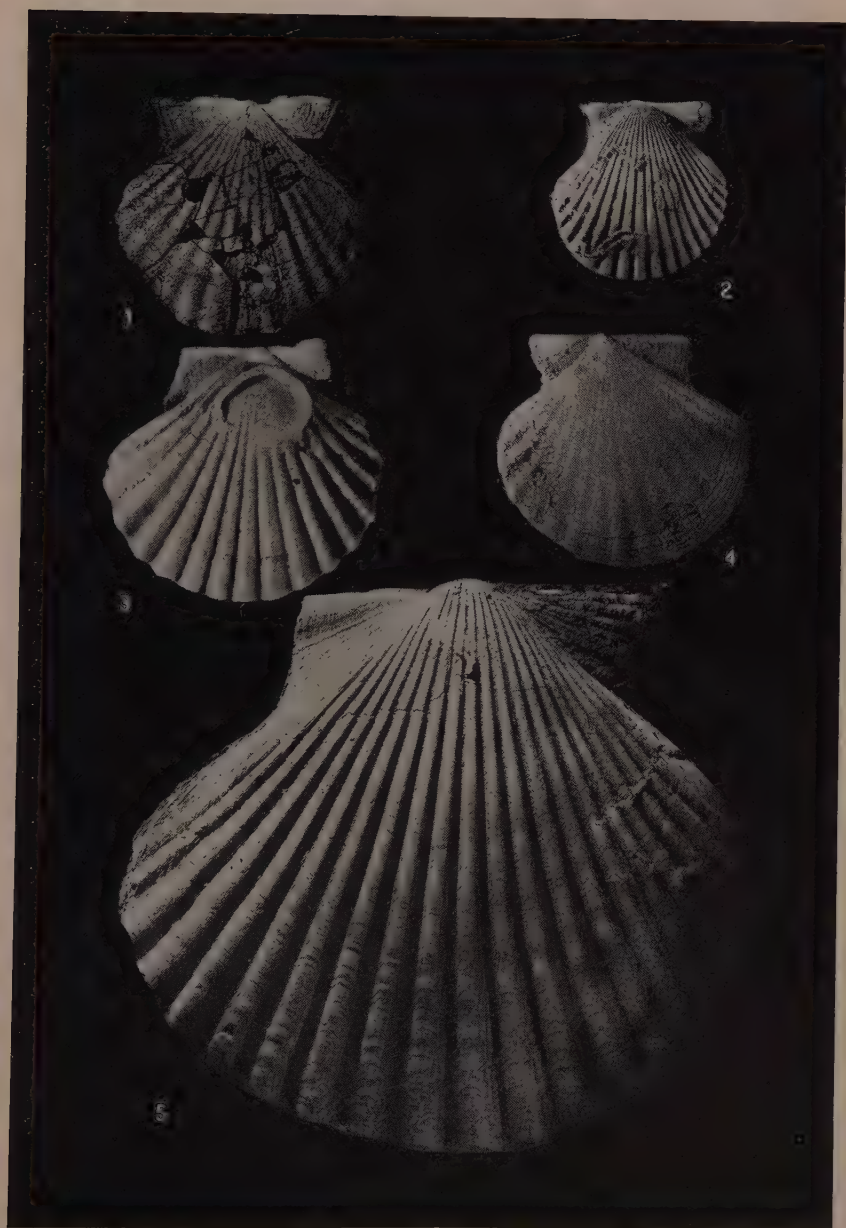
EXPLANATION OF PLATE 13

Figure		Page
1.	<i>Hyria corrugata</i> Lamarck. Recent. Para, Brazil-----	84
2.	<i>Hyria trinitaria</i> , n. sp. Pliocene. Cedros Point, Trinidad. 65 mm.-----	83



EXPLANATION OF PLATE 14

1.	<i>Pecten cercadica</i> var. <i>tabaquita</i> , n. var. 30 mm. 8½ mile post on Tabaquite road-----	88
2.	<i>Pecten gibbus</i> Linnæus. Right valve. 21 mm. Matura-----	86
3.	<i>Pecten maturensis</i> , n. sp. Right valve. 34 mm. Matura-----	89
4.	<i>Pecten maturensis</i> , n. sp. Left valve. 65 mm. Springvale--	89
5.	<i>Pecten demiurgus</i> Dall. Right valve. 65 mm. Springvale--	85

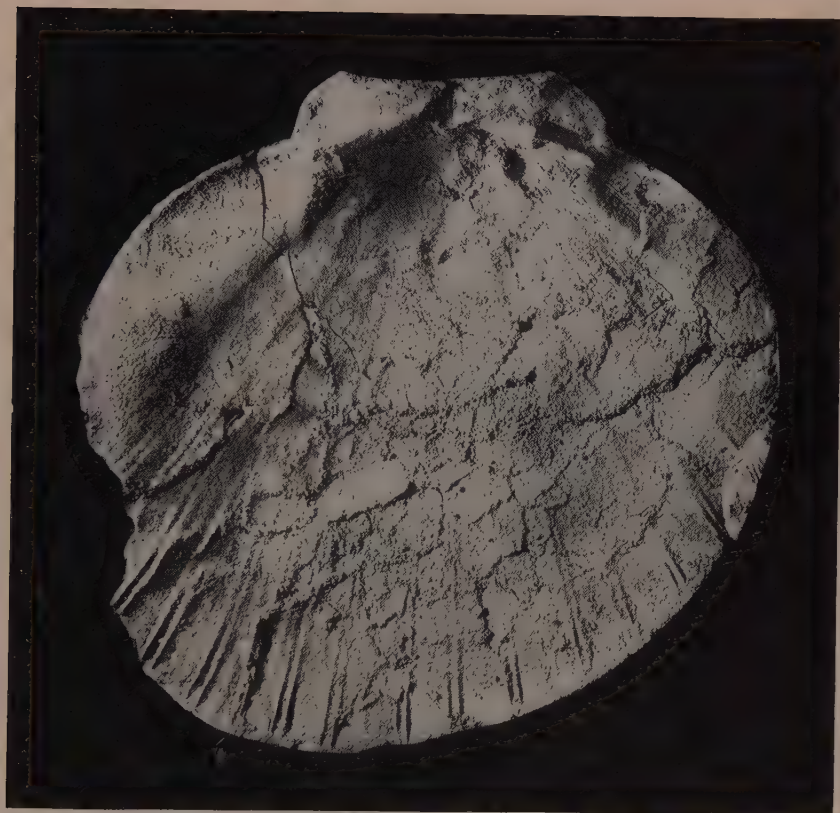


EXPLANATION OF PLATE 15

Figure

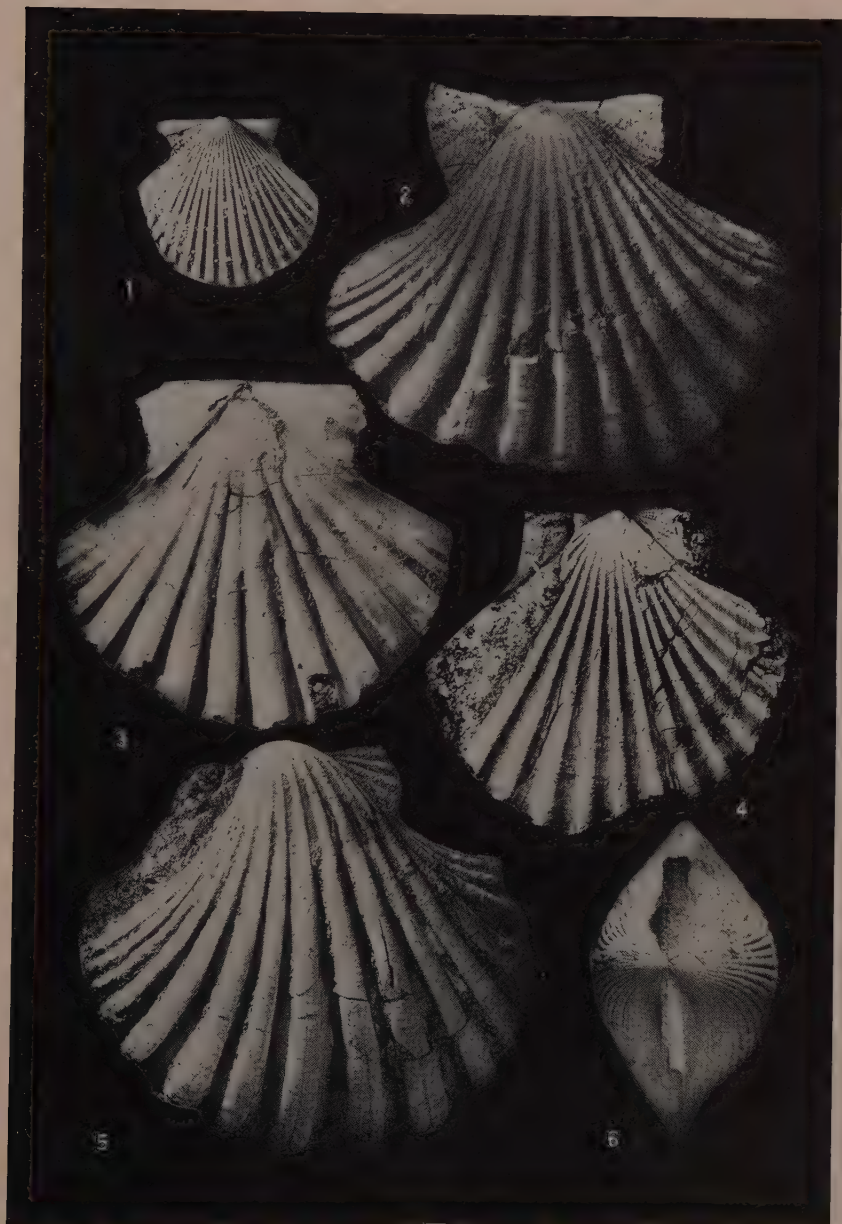
Page

- | | | |
|----|--|---------|
| 1. | <i>Anusium rex-maris</i> , n. sp. Greatly reduced. Alt 150 mm. | |
| | Springvale | -----90 |



EXPLANATION OF PLATE 16

Figure		Page
1.	<i>Pecten gibbus</i> Linnæus. Left valve. 20 mm. Matura-----	86
2.	<i>Pecten archon</i> , n. sp. Convex valve. Springvale-----	84
3.	<i>Pecten archon</i> , n. sp. Flat valve. Springvale-----	84
4.	<i>Pecten</i> cf. <i>cercadica</i> Maury. Alt. 29 mm. Top of Brasso section -----	87
5.	<i>Pecten archon</i> , n. sp. Flat valve. Springvale-----	84
6.	<i>Pecten demiurgus</i> Dall. Young shell. Dorsal view. showing relative size of the two valves. Springvale-----	85

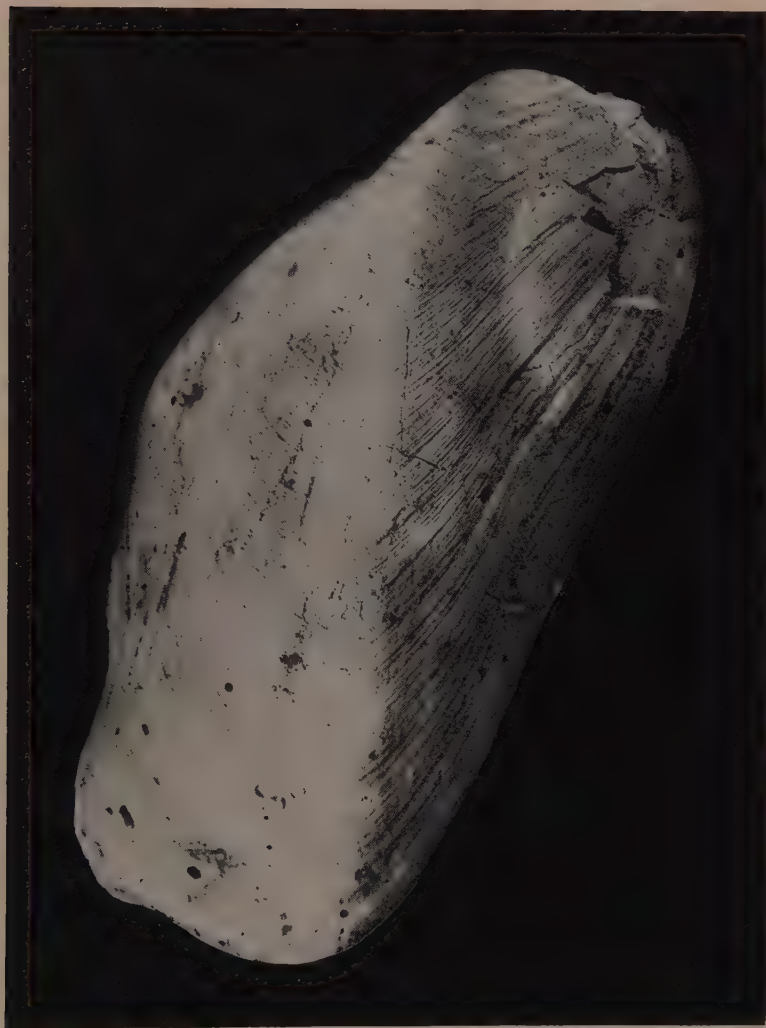


EXPLANATION OF PLATE 17

Figure

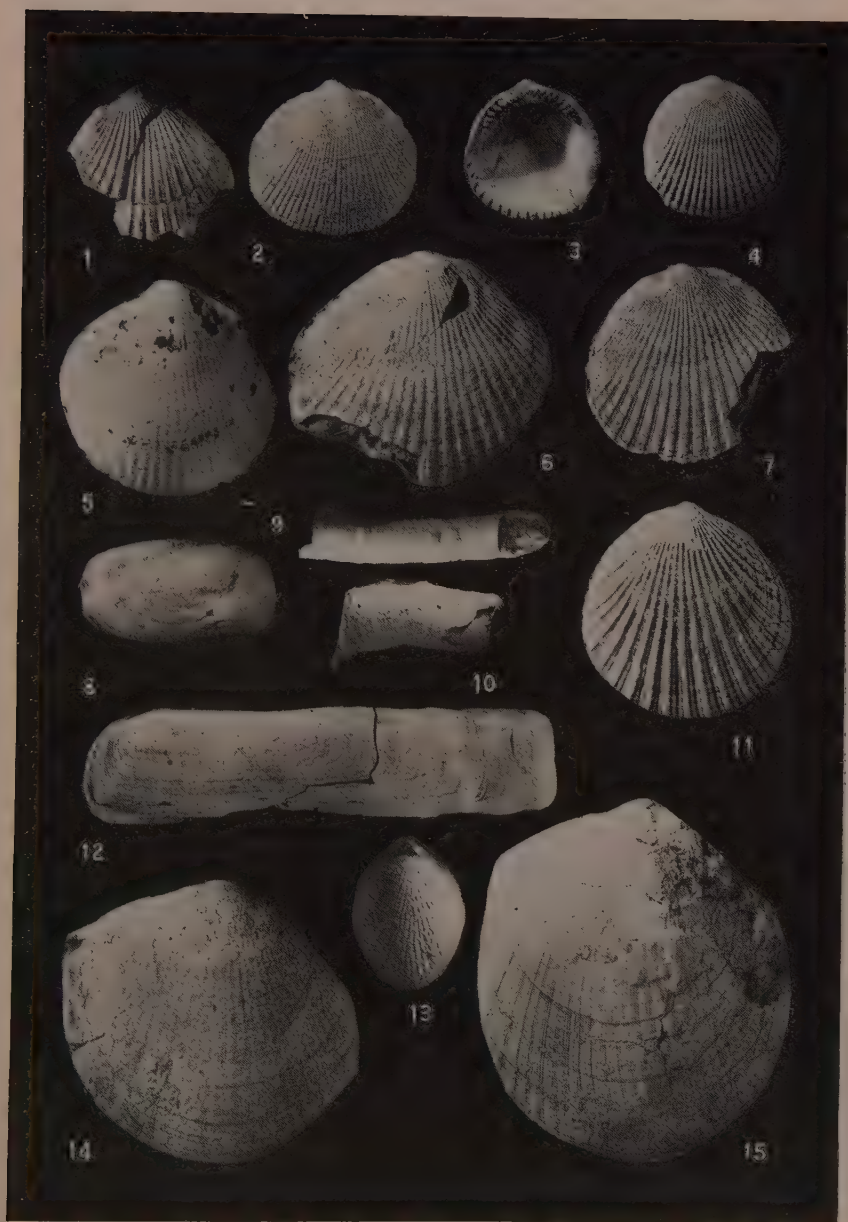
Page

1. *Modiolus waringi*, n. sp. Springvale----- 93



EXPLANATION OF PLATE 18

Figure		Page
1.	<i>Glycymeris acuticostata</i> var. <i>guaica</i> , n. var. Alt. 15 mm. 13th mile post on Guaico-Tamana road-----	32
2.	<i>Glycymeris canalis</i> var. <i>trinitensis</i> , n. var. Alt 16 mm.-----	31
3.	<i>Glycymeris canalis</i> Brown and Pilsby. Alt. 15 mm. Interior. Brasso Creek-----	31
4.	<i>Glycymeris canalis</i> Brown and Pilsby. Exterior same valve-----	31
5.	<i>Glycymeris jamaicensis</i> Dall. Alt. 23 mm. SW of Machapoorie quarry-----	29
6.	<i>Glycymeris mendoza</i> , n. sp. Alt. 25 mm. Machapoorie quarry-----	33
7.	<i>Glycymeris mendoza</i> , n. sp. Alt. 30 mm. Mendoza quarry-----	33
8.	<i>Saxicava trinitaria</i> , n. sp. Length 21 mm. Freeport-Todd's road-----	96
9.	<i>Teredo incrassata</i> Gabb. Tube fragment. Springvale-----	96
10.	<i>Terredo incrassata</i> Gabb. Tube fragment. Springvale-----	96
11.	<i>Glycymeris trilobocosta</i> Brown and Pilsby. Alt. 23 mm. Brasso Venada Ravine-----	32
12.	<i>Solen obliquous</i> Splengler, 55 mm. Matura-----	115
13.	<i>Crenella divaricata</i> d'Orbigny. Alt. 5 mm. Springvale-----	95
14.	<i>Glycymeris decussata</i> Linnæus. Alt. 31 mm. Machapoorie quarry-----	30
15.	<i>Glycymeris jamaicensis</i> var. <i>machapoorensis</i> , n. var. Alt. 40 mm. Machapoorie quarry-----	30



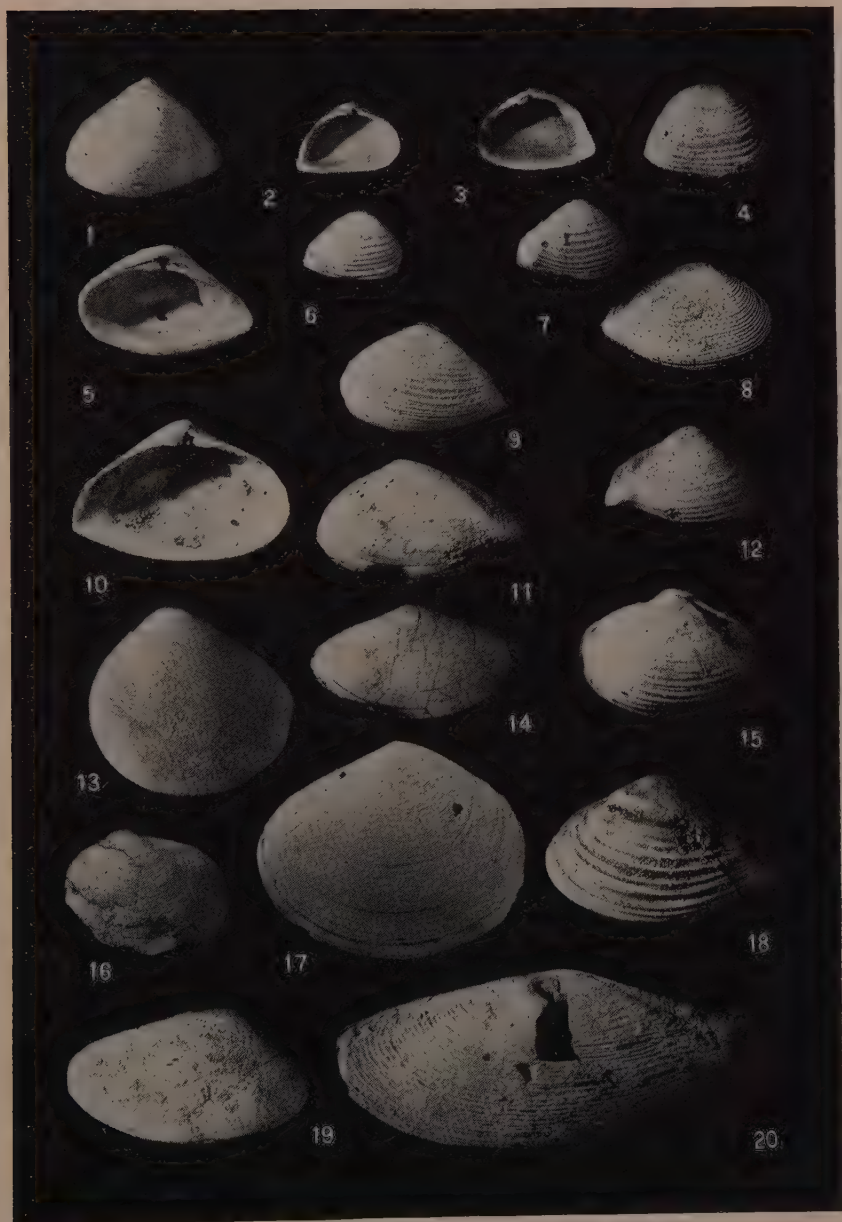
EXPLANATION OF PLATE 19

Figure	Page
1. <i>Corbula isla-trinitatis</i> , n. sp. 17 mm. Dorsal view. Brasso Junction -----	101
2. <i>Corbula sancti-dominici</i> , n. sp. Alt. 10 mm. Dominican Republic -----	98
3. <i>Corbula cieta</i> Guppy. Convex valve. Alt. 5.5 mm. Manzanilla -----	97
4. <i>Corbula vieta</i> Guppy. Smaller valve, showing radial striae. Alt. 3 mm. Manzanilla -----	97
5. <i>Corbula sancti-andreae</i> , n. sp. Dorsal view. Length 6 mm. Manzanilla -----	100
6. <i>Corbula sancti-andreae</i> , n. sp. Another specimen. Lateral view. Both valves, smaller placed upwards. Manzanilla -----	100
7. <i>Corbula sancti-andreae</i> , n. sp. Large specimen, convex valve. Length 19 mm. Manzanilla -----	100
8. <i>Corbula isla-trinitatis</i> , n. sp. Interior of convex valve. Length 19 mm. Springvale -----	101
9. <i>Corbula isla-trinitatis</i> , n. sp. Exterior of another convex valve. Length 18 mm. Springvale -----	101
10. <i>Corbula isla-trinitatis</i> , n. sp. Both valves, the smaller upwards, showing the radial threads. Length 18 mm. Brasso Junction -----	101
11. <i>Corbula arionis</i> , n. sp. Smaller shell. Length 9 mm. Matura -----	111
12. <i>Corbula arionis</i> , n. sp. Interior. Length 10 mm. Matura -----	111
13. <i>Corbula guaicoensis</i> , n. sp. Exterior right valve. Length 13 mm. Near 13th mile post, Guaico-Tamana road -----	110
14. <i>Corbula guaicoensis</i> , n. sp. Interior left valve. Length 13 mm. -----	110
15. <i>Corbula diana</i> , n. sp. Small specimen with both valves, the smaller upwards. Brasso Valley. Length 13 mm. -----	112
16. <i>Corbula diana</i> , n. sp. Large specimen, convex valve. Length 15 mm. Brasso Valley -----	112
17. <i>Corbula arionis</i> , n. sp. Large shell, convex valve. Length 12 mm. Matura -----	111
18. <i>Corbula guaicoensis</i> , n. sp. Interior. Length 14 mm. Near 13th mile post on Guaico-Tamana road -----	110
19. <i>Corbula vima</i> a Guppy. Dominican Republic. Both valves, the left showing the deep hinge cellule. Length 15 mm. -----	108
20. <i>Corbula cistellula</i> , n. sp. Length 14 mm. Fossil Ravine -----	110



EXPLANATION OF PLATE 20

Figure	Page
1. <i>Corbula hexagonella</i> , n. sp. Length 7 mm. Manzanilla-----	106
2. <i>Corbula cubaniana</i> d'Orbigny. Interior left valve. Length 6 mm. Matura-----	103
3. <i>Corbula cubaniana</i> d'Orbigny. Interior right valve. Length 7 mm. Matura-----	103
4. <i>Corbula cubaniana</i> d'Orbigny. Exterior right valve. Length 8 mm. Matura-----	103
5. <i>Corbula caribæa</i> d'Orbigny. Interior right valve. Length 11 mm. Gulf of Paria. Recent-----	102
6. <i>Corbula manzanillensis</i> , n. sp. 4 mm. Manzanilla-----	105
7. <i>Corbula manzanillensis</i> , n. sp. Length 4.5 mm. Manzanilla--	105
8. <i>Corbula caribæa</i> var. <i>pergrata</i> , n. var. Length 12 mm. Brighton, in impure asphalt-----	103
9. <i>Corbula caribæa</i> d'Orbigny. Exterior left valve. Length 11 mm. Gulf or Paria. Recent-----	102
10. <i>Corbula daphnis</i> , n. sp. Interior left valve. Length 14 mm. Matura,-----	104
11. <i>Corbula daphnis</i> , n. sp. Interior right valve. length 14 mm. Matura-----	104
12. <i>Corbula brassænsis</i> , n. sp. Length 6 mm. Matura-----	107
13. <i>Strigilla pisiformis</i> Linnæus. Length 11 mm. Matura-----	120
14. <i>Tellina waringi</i> , n. sp. Length 22 mm. Junction Mayo and Couva main roads-----	119
15. <i>Corbula helenæ</i> Maury Type. Length 8 mm. Brighton, in asphalt-----	108
16. <i>Petricola caroniana</i> , n. sp. Springvale-----	122
17. <i>Semele purpurascens</i> Gmelin. Length 15 mm. Matura-----	117
18. <i>Corbula smithiana</i> , Maury. Type. Brighton, in asphalt. Length 10 mm.-----	109
19. <i>Donax couvana</i> , n. sp. Length 27 mm. Junction Mayo and Couva main roads-----	116
20. <i>Tellina caroniana</i> , n. sp. Springvale-----	119



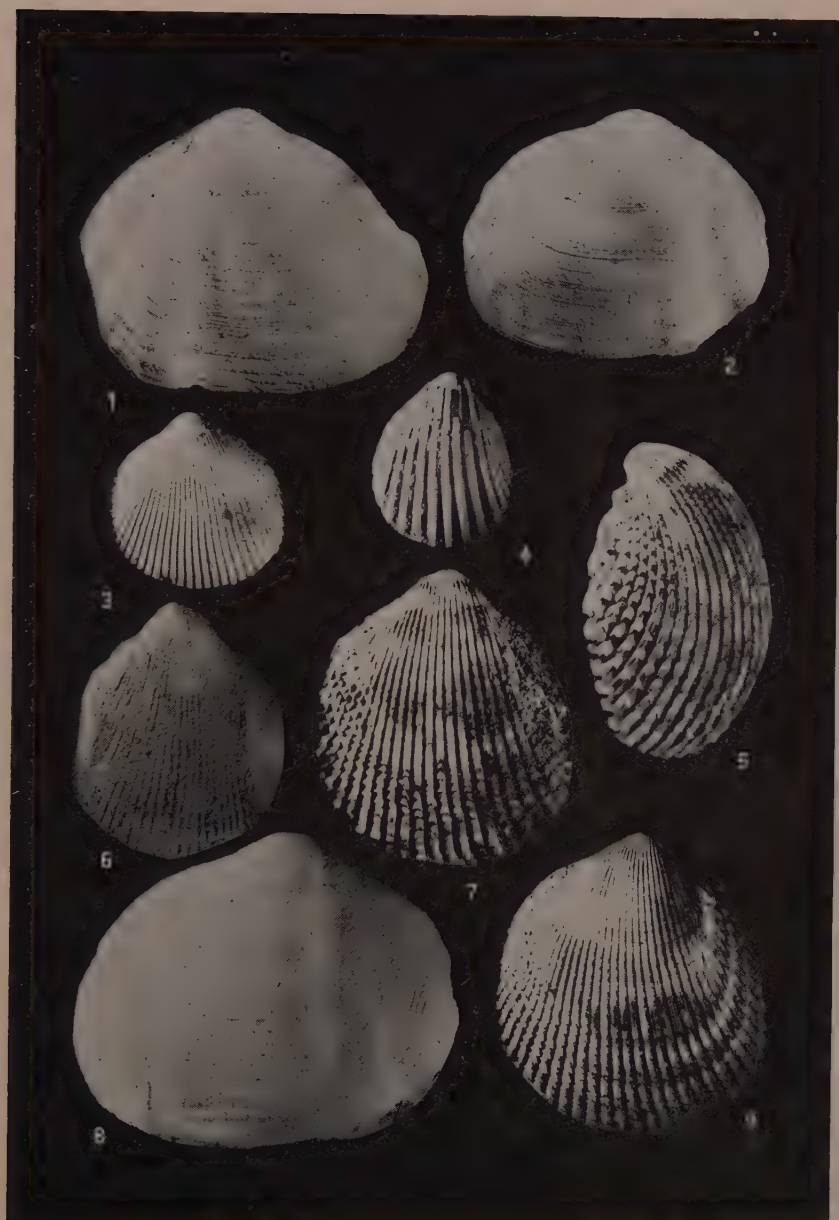
EXPLANATION OF PLATE 21

Figure	Page
1. <i>Mactra (Micromactra) macescens</i> Guppy. Length 41 mm. Manzanilla -----	113
2. <i>Mactra (Harvella) sancti-blasii</i> , n. sp. St. Blaise Ravine---	114
3. <i>Mactra (Mactrella) alata</i> Spengler. Length 80 mm. Recent. Matura Bay-----	113
4. <i>Semele claytoni</i> var. <i>couvensis</i> , n. var. Springvale-----	118
5. <i>Semele proficua</i> Pulteney. Length 32 mm. Recent. Barbados	117



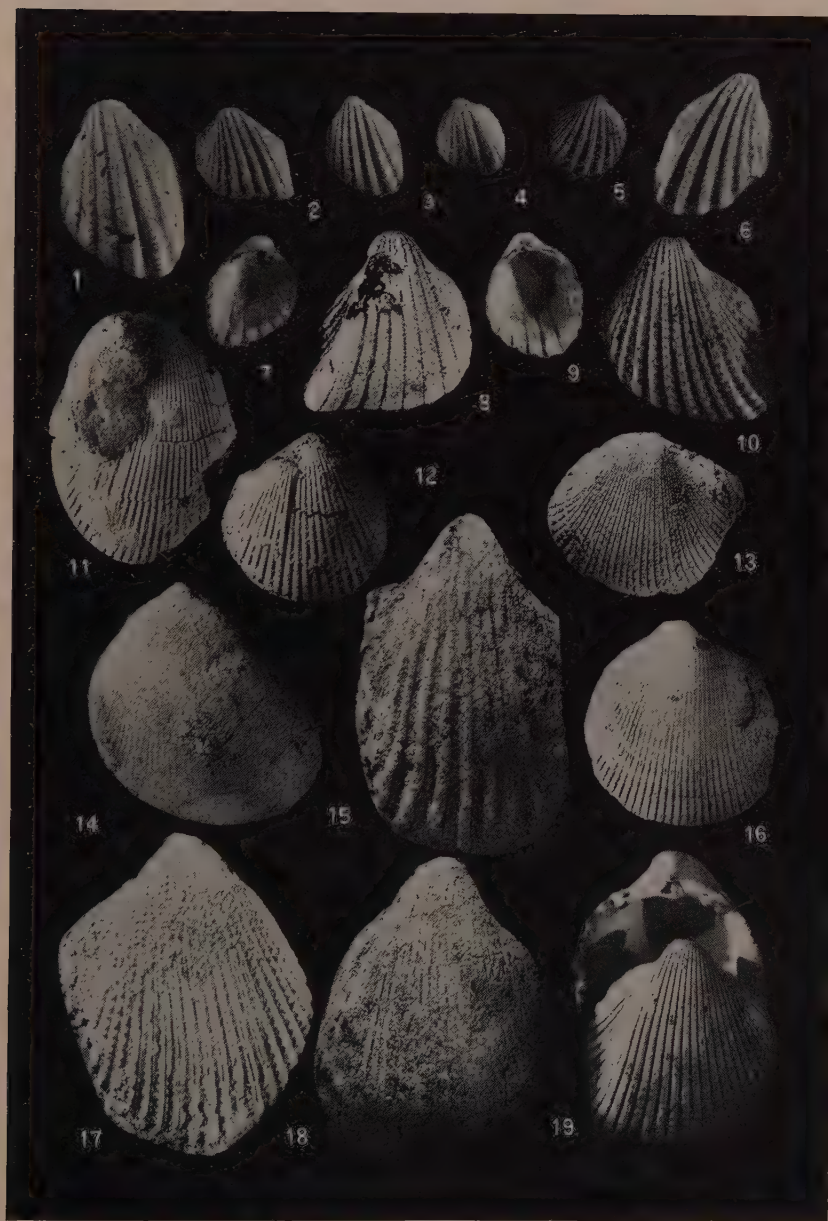
EXPLANATION OF PLATE 22

Figure	Page
1. <i>Metis trinitaria</i> Dall. Length 60 mm. Springvale_____	121
2. <i>Metis trinitaria</i> Dall. 53 mm. Springvale_____	121
3. <i>Cardium sancti-davidis</i> , n. sp. Matura_____	129
4. <i>Cardium caroniensis</i> , n. sp. Springvale_____	124
5. <i>Cardium isocardia</i> Linnæus. Recent. La Guaira, Venezuela_	125
6. <i>Cardium tamanense</i> , n. sp. East central E 25, Trinidad_____	129
7. <i>Cardium isocardia</i> Linnæus. Recent. La Guaira_____	125
8. <i>Metia trinitaria</i> Dall. Springvale_____	121
9. <i>Cardium muricatum</i> Linnæus. Erin Point. Recent_____	127



EXPLANATION OF PLATE 23

Figure	Page
1. <i>Cardium (Trigoniocardia) maturense</i> Dall. Alt. 12 mm. Matura -----	135
2. <i>Cardium (Trigoniocardia) castum</i> Guppy. Alt. 6 mm. Man- zanilla -----	132
3. <i>Cardium (Trigoniocardia) castum</i> Guppy. Alt. 6 mm. Brasso section, near bridge at Tamana road junction -----	132
4. <i>Cardium (Trigoniocardia) manzanillense</i> , n. sp. Alt. 5 mm. Manzanilla -----	133
5. <i>Cardium (Trigoniocardia) antillarum</i> d'Orbigny. Alt. 5 mm. Recent. Gulf of Paria near Farallon Rock -----	134
6. <i>Cardium (Trigoniocardia) castum</i> var. <i>brassicum</i> , n. var. Alt. 10 mm. Half a mile above Brasso -----	133
7. <i>Cardium (Trigoniocardia) castum</i> Guppy. Alt. 7 mm. Brasso section, near bridge at Tamana road junction -----	132
8. <i>Cardium (Trigoniocardia) perii-maris</i> , n. sp. Alt. 12 mm. Matura -----	136
9. <i>Cardium (Trigoniocardia) maturense</i> Dall. Alt. 8 mm. Matura -----	135
10. <i>Cardium (Trigoniocardia) mirandense</i> , n. sp. Alt. 12 mm. State of Zulia, District of Miranda, Venezuela -----	135
11. <i>Cardium venadense</i> , n. sp. 35 mm. Brasso Venada Ravine -----	130
12. <i>Cardium couvense</i> , n. sp. Springvale -----	128
13. <i>Cardium machapooriense</i> , n. sp. Fragment showing sculpture. 18 mm. Machapoorie quarry -----	131
14. <i>Cardium serratum</i> Linnæus. Alt. 33 mm. Springvale -----	138
15. <i>Cardium serratense</i> , n. sp. Half mile above Brasso Station -----	131
16. <i>Cardium venadense</i> , n. sp. Slightly enlarged. Brasso Venada Ravine -----	130
17. <i>Cardium lingua-leonis</i> Guppy. Bowden, Jamaica -----	126
18. <i>Cardium machapooriense</i> , n. sp. Alt. 33 mm. Machapoorie quarry -----	131
19. <i>Cardium (Fragum) medium</i> Linnæus. Recent. Island of Grenada -----	131



EXPLANATION OF PLATE 24

Figure	Page
1. <i>Dosinia titan</i> , n. sp. Left valve, showing elongated form. Springvale -----	139
2. <i>Dosinia titan</i> , n. sp. Very perfect right valve. Springvale--	139



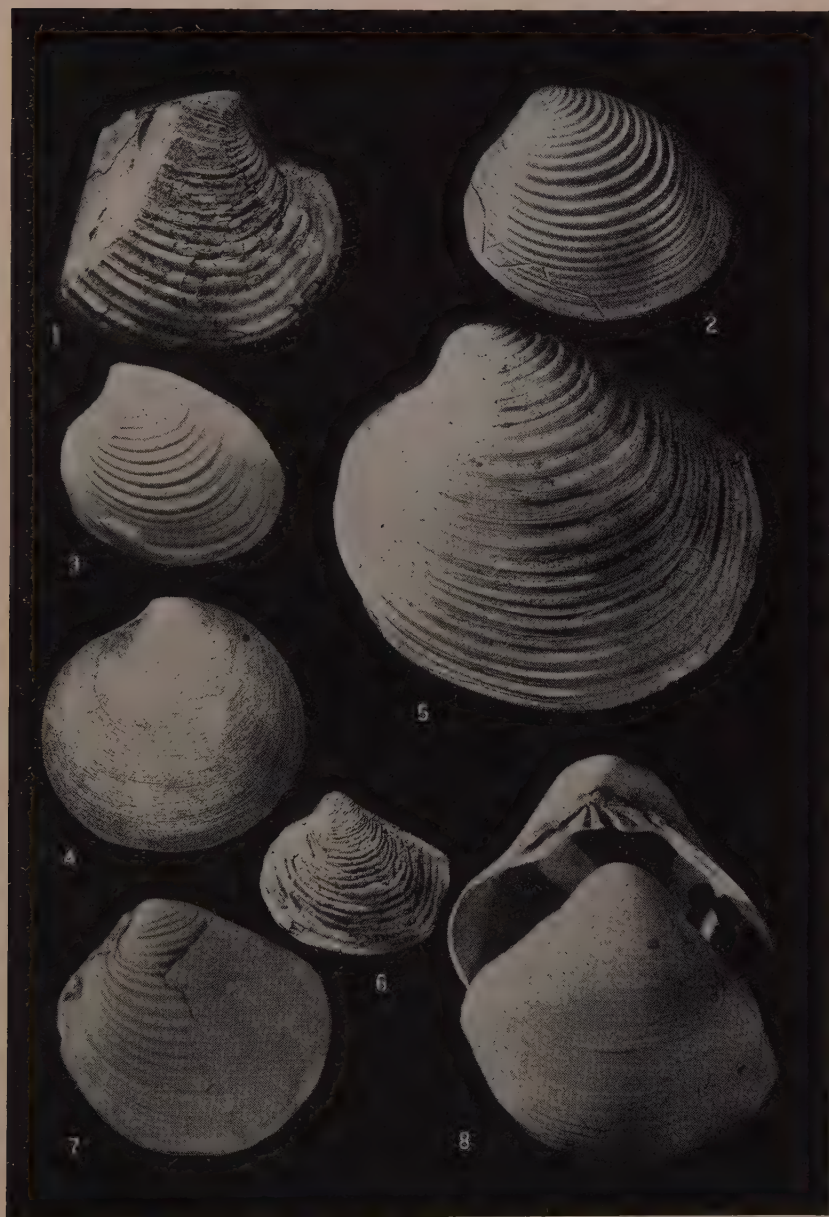
EXPLANATION OF PLATE 25

Figure	Page
1. <i>Macrocallista maculata</i> Linnæus. Young shell. Springvale..	145
2. <i>Dosinia concentrica</i> Born. Recent. Gulf of Paria, off Far- allon	141
3. <i>Dosinia titan</i> , n. sp. Dorsal view. Slightly enlarged. Spring- vale	139
4. <i>Macrocallista maculata</i> Linnæus. Adult shell. Springvale..	145
5. <i>Macrocallista maculata</i> Linnæus. Dorsal view of same speci- men	145



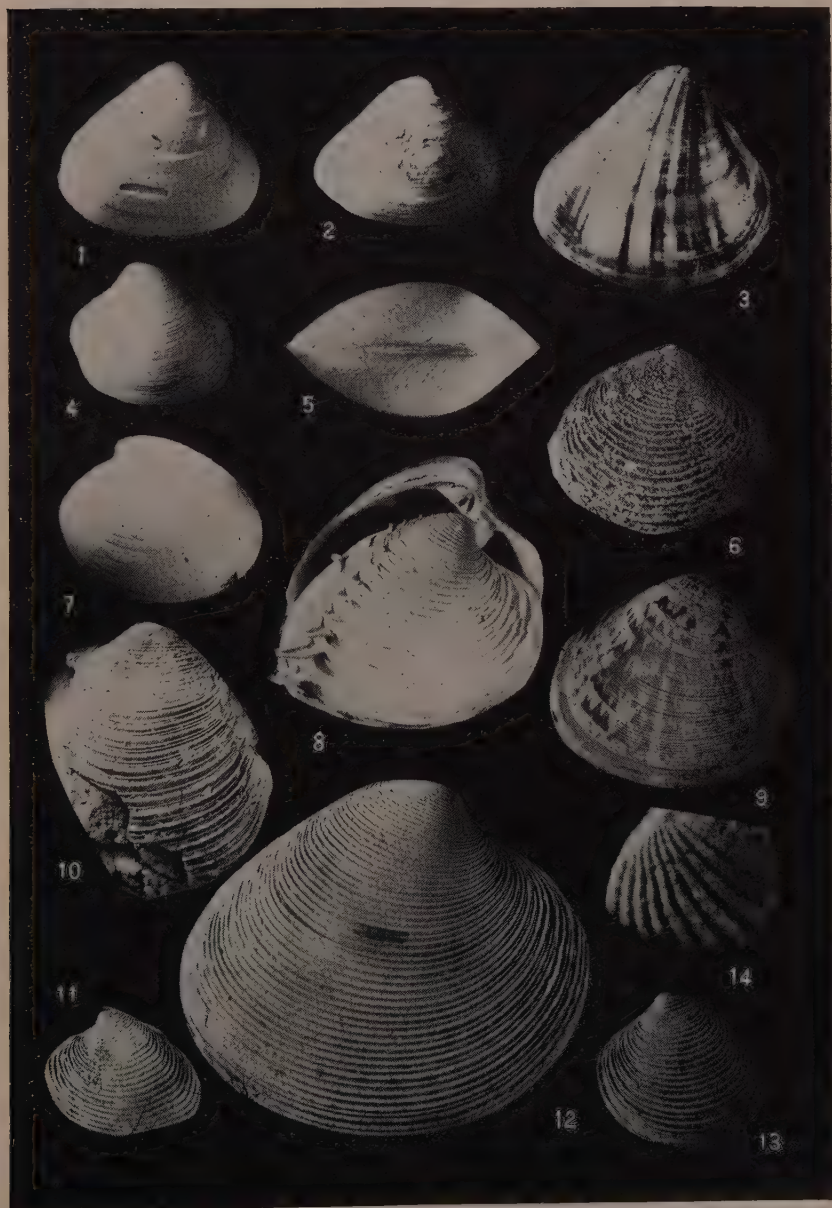
EXPLANATION OF PLATE 26

Figure	Page
1. <i>Clementia dariena</i> Conrad. Specimen with papery shell, seemingly this species. Manzanilla-----	141
2. <i>Clementia rabelli</i> Maury. Type. Porto Rico-----	142
3. <i>Clementia dariena</i> Conrad. Internal mold. Young. At 7¾ mile post on Guaico-Tamana road-----	141
4. <i>Cyclinella cyclica</i> Guppy. After Guppy, showing very perfect specimen. Manzanilla-----	151
5. <i>Clementia dariena</i> Conrad. Very fine, typical shell from the Isthmus of Panama-----	141
6. <i>Clementia</i> cf. <i>dariena</i> Conrad. Young shell. Crushed. Manzanilla -----	
7. <i>Clementia dariena</i> Conrad. Internal mold. Young. At 7¾ mile post on Guaico-Tamana road-----	141
8. <i>Tivela mactroides</i> Born. Recent. St. Thomas-----	143



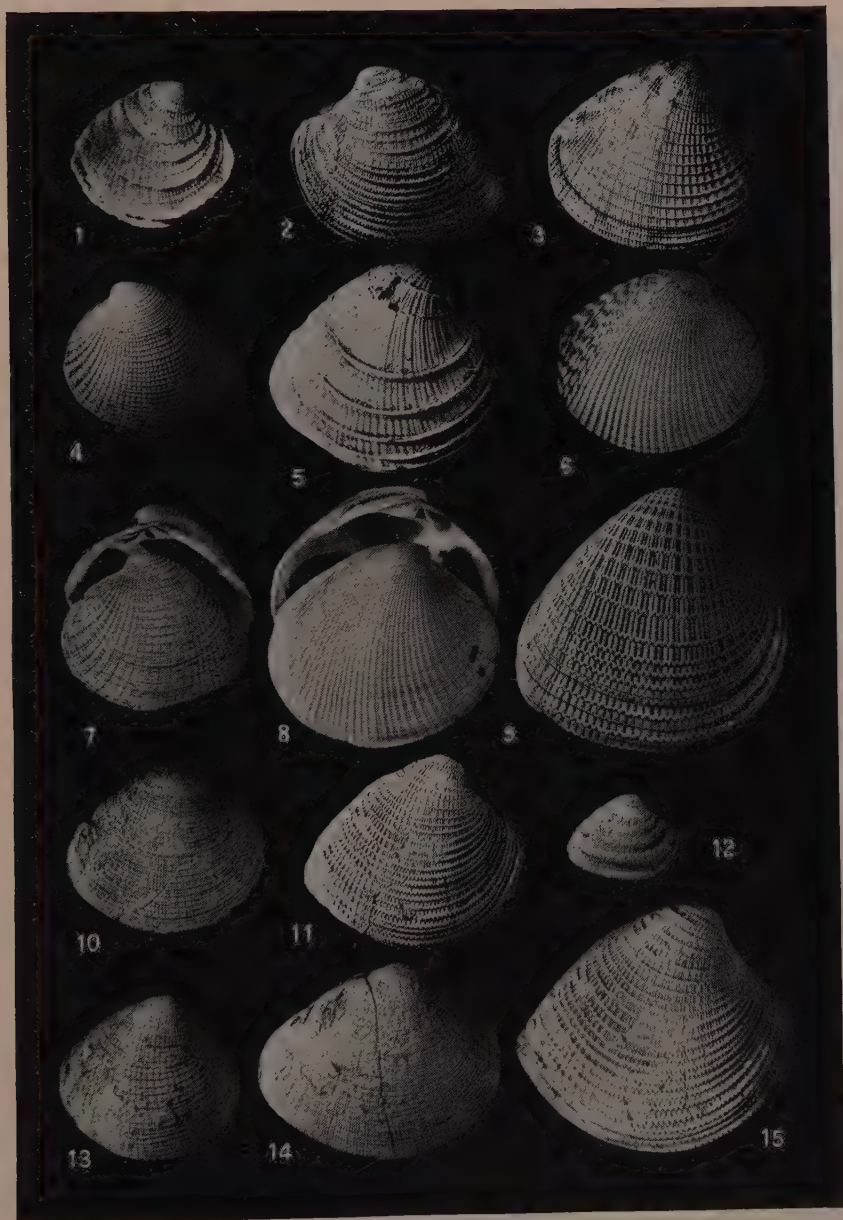
EXPLANATION OF PLATE 27

Figure	Page
1. <i>Tivela austeniana</i> var. <i>maturensis</i> , n. var. Length 26 mm. Matura -----	144
2. <i>Tivela austeniana</i> Maury. Type. Length 26 mm. Brighton	144
3. <i>Tivela mactroides</i> Born. Erin Point. Recent. Showing color pattern -----	143
4. <i>Pitaria catharinæ</i> , n. sp. Length 19 mm. Ravine south of Brasso -----	148
5. <i>Callocardia gatunensis</i> Dall. Dorsal view. NW. $\frac{1}{4}$ H 24, Trinidad -----	146
6. <i>Pitaria circinata</i> var. <i>juncea</i> Guppy. Length 24 mm. Macha- poorie -----	150
7. <i>Callocardia gatunensis</i> Dall. Length 33 mm. NW. $\frac{1}{4}$ H 24, Trinidad -----	146
8. <i>Pitaria dione</i> Linnæus. Erin Point. Recent. -----	149
9. <i>Pitaria fulminata</i> Menke. Erin Point. Recent. Showing color pattern -----	147
10. <i>Pitaria circinata</i> var. <i>juncea</i> Guppy. Alt. 30 mm. Macha- poorie -----	150
11. <i>Pitaria labreana</i> Maury. Length 19 mm. Type Brighton	151
12. <i>Pitaria circinata</i> Born. 18 mm. Matura -----	149
13. <i>Pitaria circinata</i> Born. Length 44 mm. Recent. La Guiara	149
14. <i>Erycinella</i> (<i>Carditopsis</i>) <i>guppyi</i> , n. sp. Length 2.5 mm. Springvale -----	172



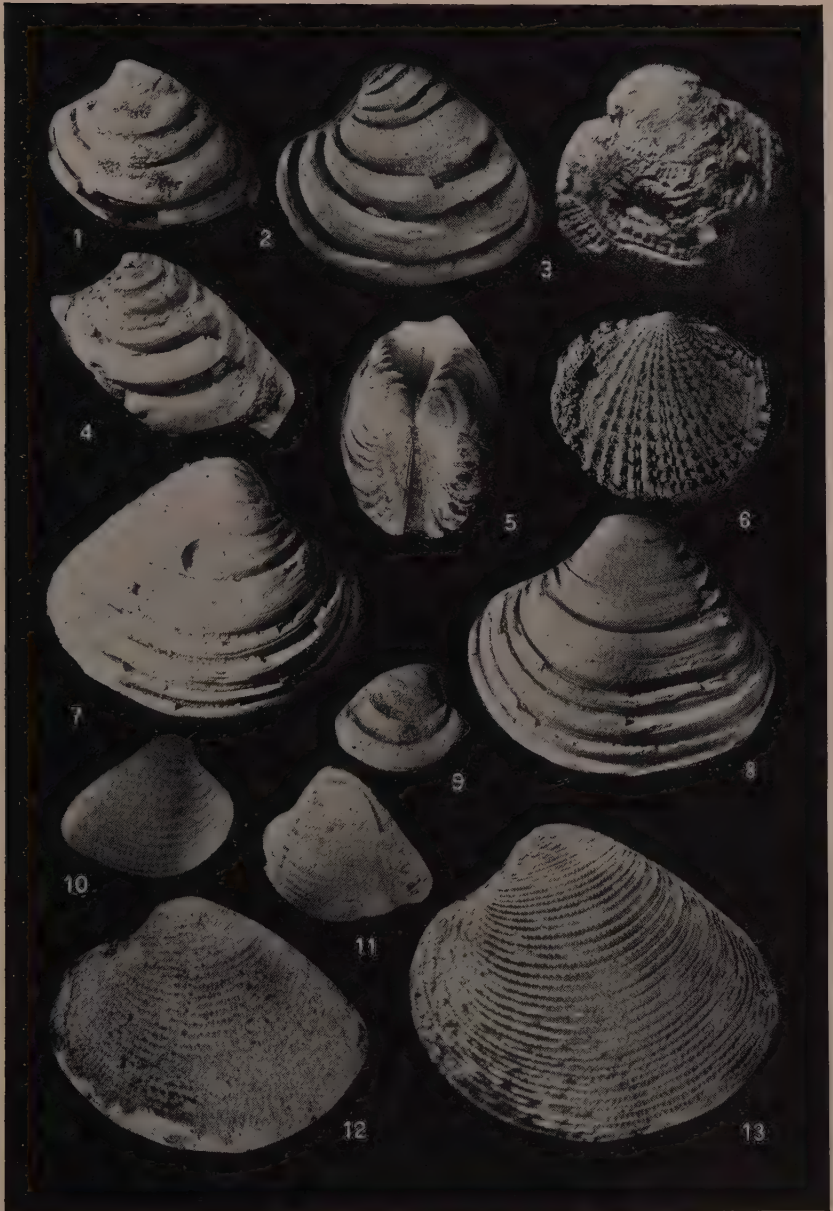
EXPLANATION OF PLATE 28

Figure		Page
1.	<i>Chione cancellata</i> Linnæus. Length 20 mm. Matura-----	153
2.	<i>Chione walli</i> Guppy. Left valve. Manzanilla-----	159
3.	<i>Chione portesiana</i> d'Orbigny. Length 25 mm. Erin Point. Recent -----	155
4.	<i>Chione dalliana</i> var. <i>guppyiana</i> Maury. Length 19 mm. Matura -----	158
5.	<i>Chione cancellata</i> Linnæus. Gulf of Paria, off Farallon Rock	153
6.	<i>Chione pectorina</i> Lamarck. Recent. Trinidad. Showing color pattern -----	164
7.	<i>Chione portesiana</i> var. <i>beauvi</i> Récluz. Guadeloupe Isl. Type locality -----	155
8.	<i>Chione pectorina</i> Lamarck. Recent. Trinidad-----	157, 164
9.	<i>Chione amathusia</i> Philippi. Recent. Gulf of California----	159
10.	<i>Chione dalliana</i> Maury. Type. Length 22 mm. Brighton----	156
11.	<i>Chione walli</i> Guppy. Right valve. Manzanilla-----	159
12.	<i>Chione</i> (<i>Clausinella</i> ?) <i>sancti-davidis</i> , n. sp. Length 9 mm. Matura -----	161
13.	<i>Chione dalliana guppyiana</i> Maury. Type. Length 20 mm. Brighton -----	158
14.	<i>Chione dalliana veatchiana</i> Maury. Type. Length 25 mm. Brighton -----	157
15.	<i>Chione walli</i> Guppy. Enlarged to show details of sculpture and for comparison with <i>amathusia</i> . Manzanilla-----	159



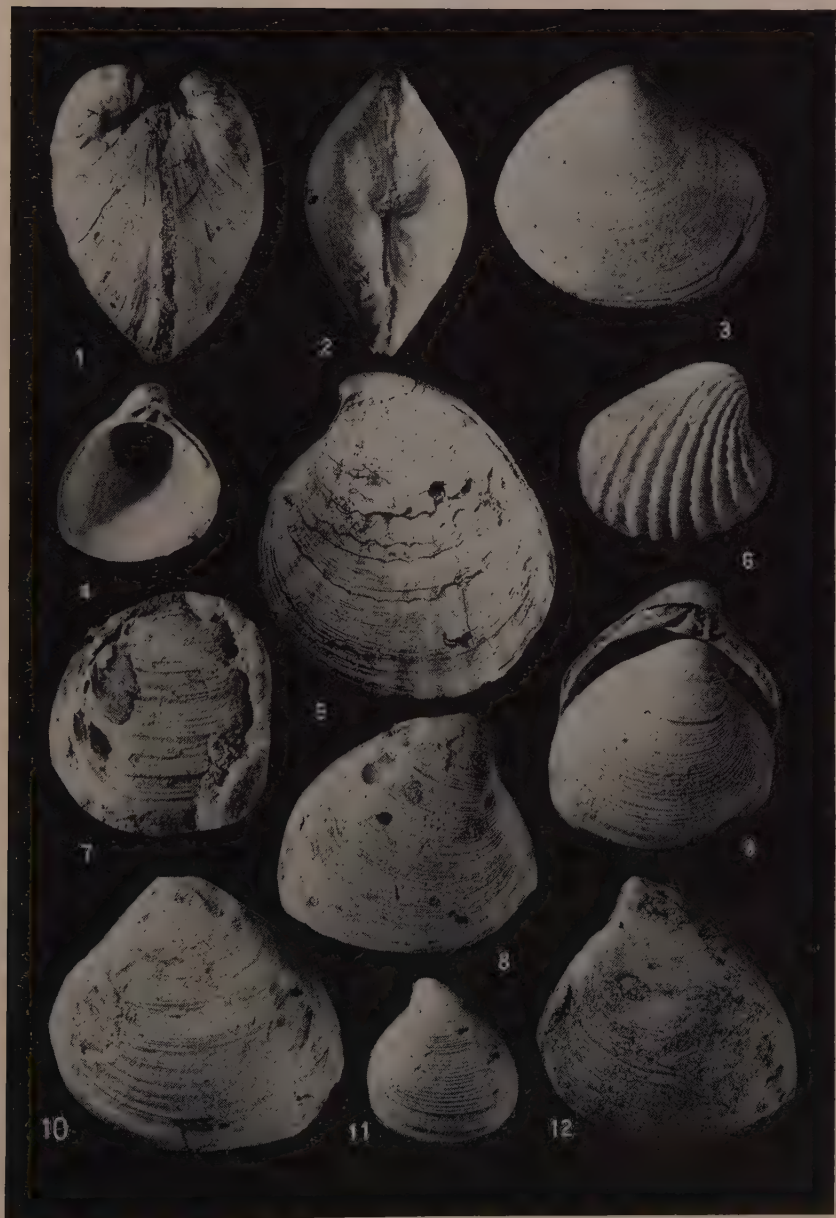
EXPLANATION OF PLATE 29

Figure	Page
1. <i>Chione latilirata</i> Conrad. Length 25 mm. 400 feet north of Matura River -----	161
2. <i>Chione latilirata</i> Conrad. North Carolina. Length 30 mm.-----	161
3. <i>Chama involuta</i> Guppy. Length 20 mm. Brasso Creek-----	168
4. <i>Chione riomaturensis</i> , n. sp. 400 feet north of Matura River. Somewhat enlarged -----	162
5. <i>Chione caroniana</i> , n. sp. Dorsal view. Both valves. Springvale -----	163
6. <i>Phacoides (Lucinisca) roigi</i> , n. sp. Length 11 mm. Matura-----	167
7. <i>Chione caroniana</i> , n. sp. Right valve. Length 31 mm. Springvale -----	163
8. <i>Chione caroniana</i> , n. sp. Left valve of same specimen. Length 31 mm. Springvale-----	163
9. <i>Chione latilirata</i> Conrad. Dwarfed. Length 13 mm. Matura-----	161
10. <i>Anomalocardia brasiliiana</i> Lamarck. Recent. Brazil. Length 20 mm. -----	165
11. <i>Anomalocardia brasiliiana</i> Lamarck. Freeport-Todd's road at the 2nd mile post. Length 21 mm-----	165
12. <i>Chione pubera</i> Valenciennes. Springvale. Artificial cast from mold -----	160
13. <i>Chione pubera</i> Valenciennes. Recent. Brazil-----	160



EXPLANATION OF PLATE 30

Figure		Page
1.	<i>Corbicula (Cyanocyclus) comparana</i> , n. sp. Anterior view, both valves. Alt. 31 mm. Cedros Point-----	173
2.	<i>Thyasira sancti-andreae</i> , n. sp. Dorsal view. Manzanilla-----	166
3.	<i>Thyasira sancti-andreae</i> , n. sp. Lateral view. Manzanilla-----	166
4.	<i>Corbicula (Cyanocyclus) comparana</i> , n. sp. Young shell. Alt. 18 mm. From ½ mile on Comparo road-----	173
5.	<i>Venericardia terryi</i> var. <i>brassica</i> , n. var. Alt. 32 mm. Brasso-----	171
6.	<i>Venericardia trinidadensis</i> , n. sp. Length 26 mm. Brasso Venada Ravine-----	171
7.	<i>Corbicula (Cyanocyclus) coubarillia</i> , n. sp. Alt. 28 mm. Point Coubaril, Brighton-----	174
8.	<i>Corbicula (Cyanocyclus) comparana</i> , n. sp. Alt. 25 mm. Cedros Point-----	173
9.	<i>Corbicula (Cyanocyclus) caroniuna</i> , n. sp. Alt. 19 mm. Young shell. Freeport-Todd's road, ½ mile post-----	174
10.	<i>Corbicula (Cyanocyclus) comparana</i> , n. sp. Alt. 30 mm. ½ mile on Comparo road-----	173
11.	<i>Corbicula (Cyanocyclus) comparana</i> , n. sp. Alt. 17 mm. Young shell. From ½ mile on Comparo road-----	173
12.	<i>Corbicula (Cyanocyclus) comparana</i> , n. sp. Alt. 29 mm. Nearly adult specimen with uneroded, high beak. ½ mile on Comparo road-----	173



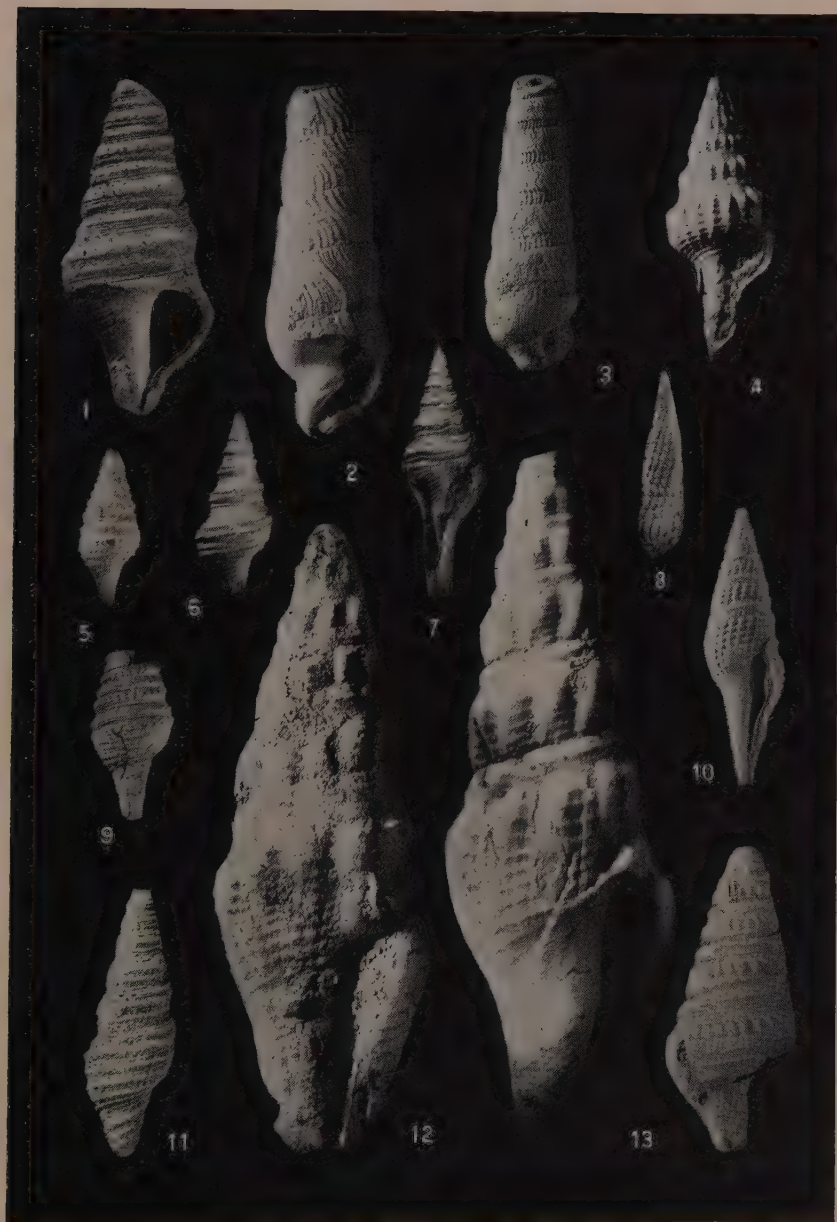
EXPLANATION OF PLATE 31

Figure	Page
1. <i>Crassatellites (Scambula) trinitarius</i> , n. sp. Young shell. Length 39 mm. Springvale-----	175
2. <i>Crassinella martinicensis</i> d'Orbigny. Alt. 5 mm. Matura----	178
3. <i>Crassatellites (Scambula) montserratensis</i> , n. sp. Springvale	176
4. <i>Crassinella guadalupensis</i> d'Orbigny. Alt. 5 mm. Matura--	177
5. <i>Crassinella guppyi</i> Dall. Alt. 5 mm. Springvale-----	177
6. <i>Crassinella guadalupensis</i> d'Orbigny. Exterior, same valve as Fig. 4. Alt. 5 mm. Matura-----	177
7. <i>Crassatellites (Scambula) trinitarius</i> , n. sp. Adult shell. Dorsal view. Springvale-----	175
8. <i>Pholadomya walli</i> , n. sp. Dorsal view. Posterior end lacking. Diameter 50 mm. Guaico-Tamana road quarry-----	180
9. <i>Thracia (Cyathodonta) meridionalis</i> Guppy. Alt. 33 mm. Springvale -----	179
10. <i>Pholadomya sawkinsi</i> , n. sp. Length 45 mm. Machapoorie quarry -----	181
11. <i>Pholadomya walli</i> , n. sp. Lateral view, same specimen as Fig. 8. Alt. 50 mm. Guaico-Tamana road quarry-----	180



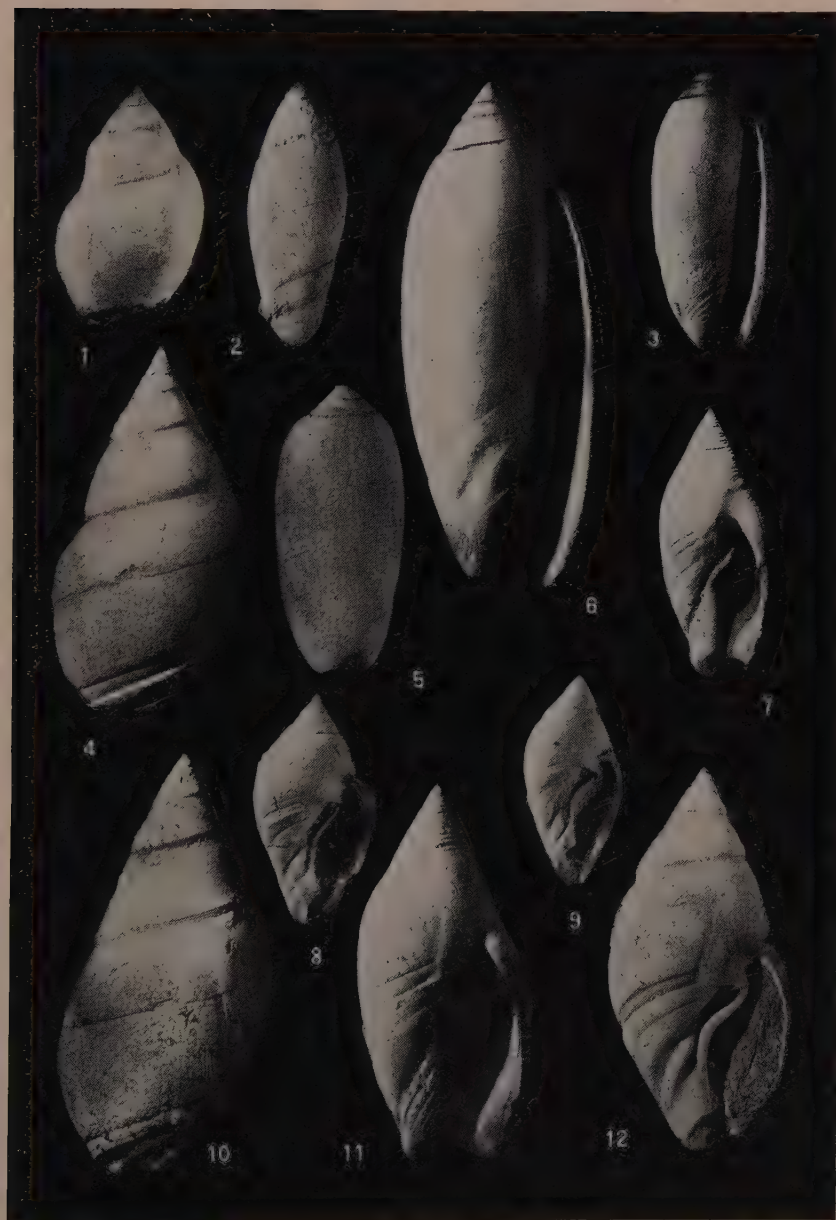
EXPLANATION OF PLATE 32

Figure	Page
1. <i>Drillia vaningeni</i> var. <i>sancti-andreæ</i> , n. var. Height 29 mm. Near 11th mile post on Caparo road-----	191
2. <i>Terebra bipartita</i> Sowerby. Springvale-----	183
3. <i>Terebra sulcifera</i> Sowerby. Brasso Venada Ravine-----	182
4. <i>Drillia manzanillica</i> , n. sp. Height 23 mm. Manzanilla-----	190
5. <i>Drillia vaningeni</i> var. <i>machapoorensis</i> , n. var. Height 13 mm. At 13th mile post on Guaico-Tamana road-----	191
6. <i>Turris albida</i> var. <i>sancti-davidis</i> , n. var. Height 15 mm. Manzanilla -----	188
7. <i>Turris albida</i> var. <i>sancti-davidis</i> , n. var. Height 15 mm. Manzanilla -----	188
8. <i>Terebra manzanillica</i> , n. sp. Height 16 mm. Manzanilla-----	184
9. <i>Drillia vaningeni</i> var. <i>machapoorensis</i> , n. var. Height 15 mm. At 13th mile post on Guaico-Tamana road-----	191
10. <i>Drillia consors</i> Sowerby. Height 25 mm. At 13th mile post on Guaico-Tamana road-----	190
11. <i>Turris albida</i> Perry. Brasso Venada Ravine-----	187
12. <i>Drillia henekeni</i> var. <i>caroniana</i> , n. var. Height 52 mm. Springvale -----	188
13. <i>Drillia henekeni</i> Sowerby. Height 55 mm. At 11th mile post on Caparo road-----	188
14. <i>Drillia vaningeni</i> var. <i>sancti-andreæ</i> , n. var. Height 23 mm. At 11th mile post on Caparo road-----	191



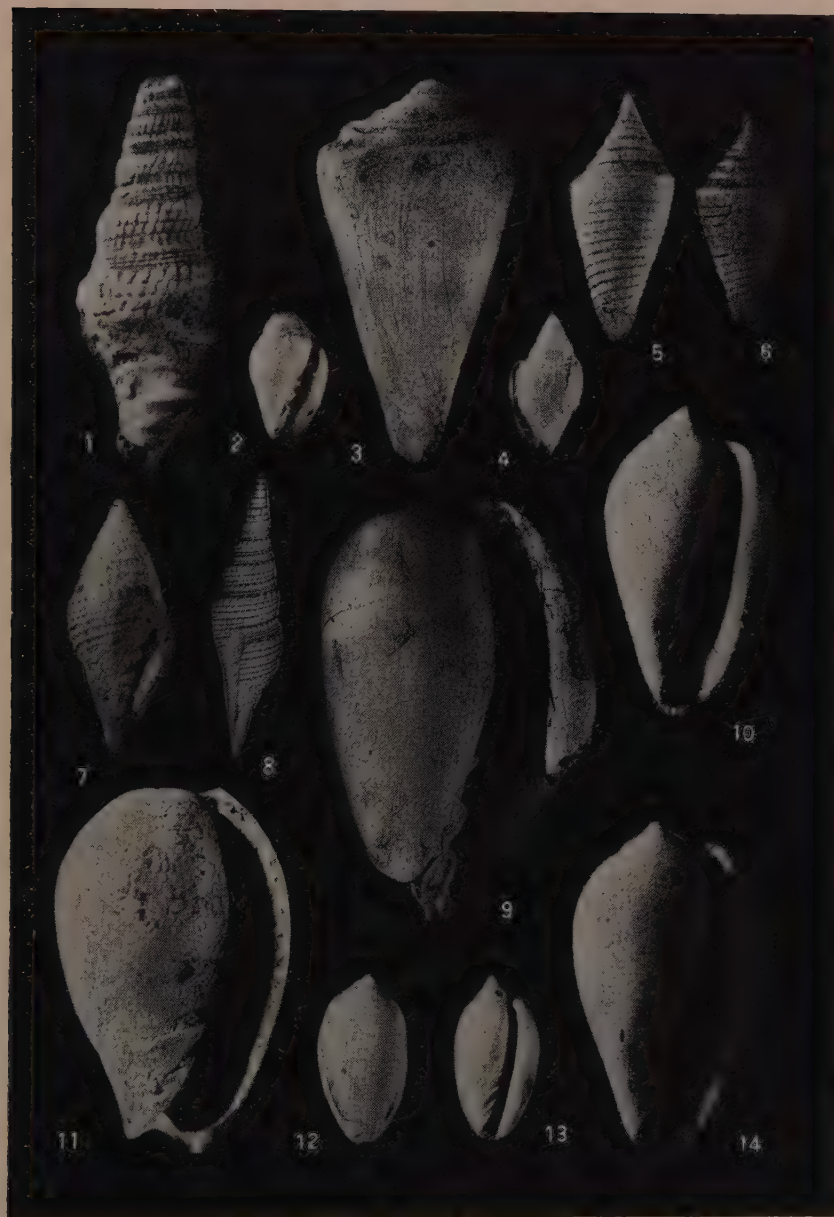
EXPLANATION OF PLATE 33

Figure		Page
1.	<i>Ancilla brassica</i> , n. sp. Height 30 mm. Brasso District	199
2.	<i>Olivella mutica</i> Say. Height 8 mm. Springvale	197
3.	<i>Oliva cylindrica</i> Sowerby. Height 45 mm. Springvale	195
4.	<i>Ancilla caroniana</i> , n. sp. Height 47 mm. Springvale	198
5.	<i>Oliva cylindrica</i> Sowerby. Height 45 mm. Springvale	195
6.	<i>Oliva couvana</i> , n. sp. Height 80 mm. Springvale	195
7.	<i>Ancilla lamellata</i> Guppy. Height 29 mm. NE. quarter E 24	197
8.	<i>Ancilla brassica</i> , n. sp. Height 26 mm. Half mile above Brasso Station	199
9.	<i>Ancilla brassica</i> , n. sp. Height 15 mm. At 13th mile post on Guaico-Tamana road	199
10.	<i>Ancilla caroniana</i> , n. sp. Height 60 mm. Springvale	198
11.	<i>Ancilla lamellata</i> Guppy. Height 30 mm. NE. quarter E 24	197
12.	<i>Ancilla caroniana</i> , n. sp. Springvale	198



EXPLANATION OF PLATE 34

Figure	Page
1. <i>Scobinella morierei</i> (Laville) Cossmann. Height 30 mm. Brasso Venada Ravine-----	193
2. <i>Marginella guaica</i> , n. sp. Height 11 mm. 13th mile post on Guaico-Tamana road -----	200
3. <i>Conus stenostoma</i> Sowerby. 50 mm. Springvale-----	185
4. <i>Marginella guaica</i> , n. sp. Height 13 mm. 13th mile post on Guaico-Tamana road -----	200
5. <i>Conus burckhardti</i> Böse. Height 18 mm. 13th mile post on Guaico-Tamana road -----	187
6. <i>Conus planiliratus</i> Sowerby. Height 28 mm. Springvale----	186
7. <i>Borsonia varicosa</i> Sowerby. Height 19 mm. Brasso Venada Ravine -----	192
8. <i>Scobinella morierei</i> (Laville) Cossmann. Type. After Coss- mann -----	193
9. <i>Marginella (Volutella) maiæ</i> , n. sp. Height 54 mm. Spring- vale -----	201
10. <i>Marginella springvalensis</i> , n. sp. Height 40 mm. Springvale	200
11. <i>Marginella (Persicula) couviana</i> , n. sp. Height 11 mm. Springvale -----	202
12. <i>Marginella calypsonis</i> , n. sp. Height 23 mm. Springvale----	199
13. <i>Marginella calypsonis</i> , n. sp. Height 21 mm. Springvale----	199
14. <i>Marginella springvalensis</i> , n. sp. Height 43 mm. Springvale	200



EXPLANATION OF PLATE 35

Figure		Page
1.	<i>Mitra longa couvensis</i> , n. var. Springvale-----	203
2.	<i>Mitra henekeni</i> Sowerby. Dominican Republic-----	202
3.	<i>Melanella (Eulima) egregia</i> Guppy. Springvale-----	215
4.	<i>Mitra longa</i> var. <i>couvensis</i> , n. var. Springvale-----	203
5.	<i>Turricula bristoli</i> , n. sp. Height 12 mm. Brasso Junction quarry -----	205
6.	<i>Cancellaria montserratensis</i> , n. sp. Springvale-----	194
7.	<i>Cancellaria epistomifera</i> Guppy. Height 30 mm. Springvale-----	193
8.	<i>Cancellaria montserratensis</i> , n. sp. Springvale-----	194
9.	<i>Hemisinus comparanus</i> , n. sp. Height 22 mm. ½ mile on Comparo road -----	235
10.	<i>Hemisinus comparanus</i> , n. sp. Height 21 mm. ½ mile on Comparo road -----	235
11.	<i>Fusus springvalensis</i> , n. sp. Springvale-----	206
12.	<i>Melongena consors</i> Sowerby. Junction Mayo and Couva main roads -----	208
13.	<i>Mitra sancti-francisci</i> , n. sp. Springvale-----	204



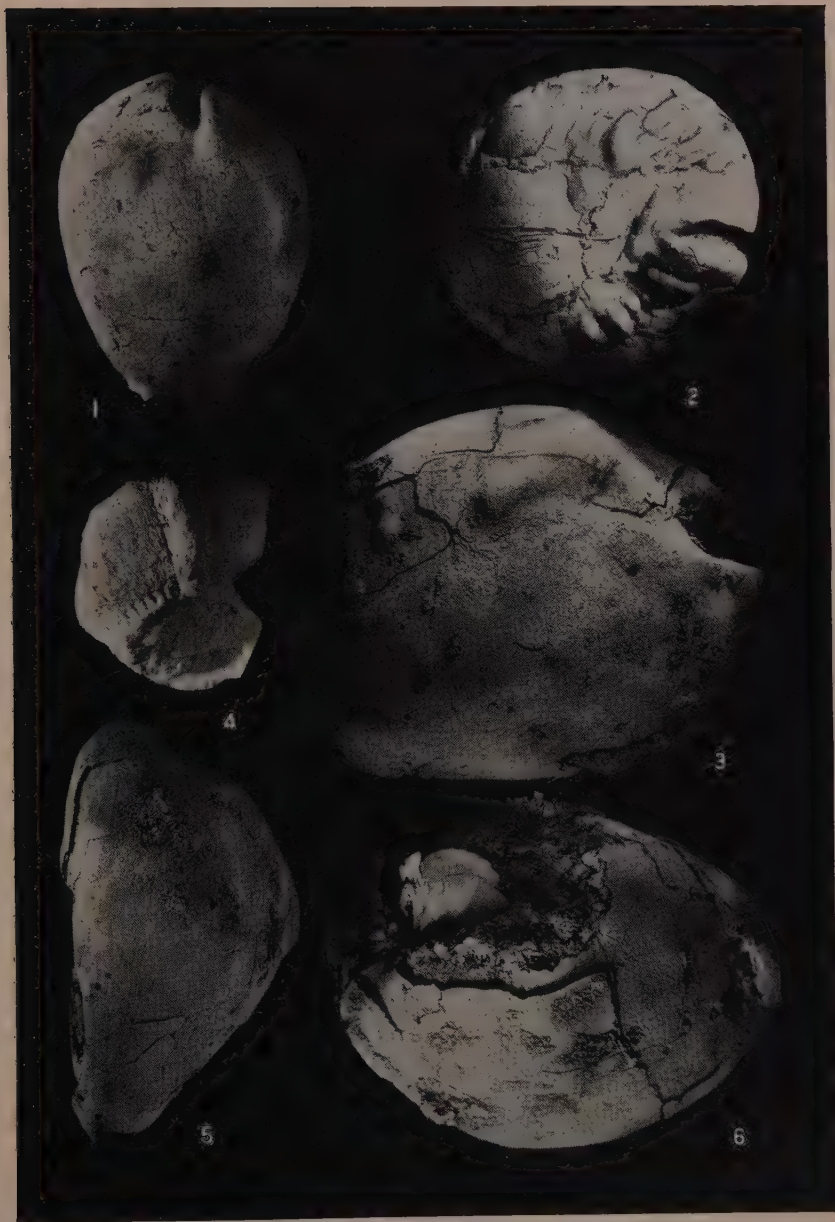
EXPLANATION OF PLATE 36

Figure		Page
1.	<i>Solenosteira semiglobosa</i> Guppy. Springvale	209
2.	<i>Strombus bifrons</i> Sowerby. Height 38 mm. Dominican Republic	221
3.	<i>Solenosteira cochlearis</i> Guppy. Springvale	210
4.	<i>Typhis linguiferus</i> Dall. Height 14 mm. 13th mile post on Guaico-Tamana road	214
5.	<i>Typhis linguiferus</i> Dall. Height 13 mm. 13th mile post on Guaico-Tamana road	214
6.	<i>Typhis alatus</i> var. <i>obesus</i> Ga5b. 29 mm. 11th mile post Caparo road	214
7.	<i>Malea camura</i> Guppy. Height 45 mm. Dominican Republic	218
8.	<i>Columbella inflata</i> var. <i>brassica</i> , n. var. Height 18 mm. Brasso	211
9.	<i>Typhis alatus</i> var. <i>obesus</i> Gabb. Height 29 mm. 11th mile post on Caparo road	214
10.	<i>Strombina guaica</i> , n. sp. Height 18 mm. 13th mile post on Guaico-Tamana road	212
11.	<i>Strombina guaica</i> , n. sp. Height 16 mm. 13th mile post on Guaico-Tamana road	212
12.	<i>Alectrion brassica</i> , n. sp. Height 7 mm. Brasso Junction quarry	210



EXPLANATION OF PLATE 37

Figure	Page
1. <i>Cypræa henekeni</i> Sowerby. Length 55 mm. 11th mile post on Caparo road-----	219
2. <i>Cypræa henekeni</i> var. <i>lacrimula</i> , n. var. Eastern E 24-----	220
3. <i>Cypræa caroniensis</i> , n. sp. Springvale-----	221
4. <i>Epitonium</i> (<i>Cirsotrema</i>) <i>tamanense</i> , n. sp. Height 20 mm. 13 $\frac{1}{8}$ miles on Cunapo southern road-----	242
5. <i>Cypræa caroniensis</i> , n. sp. Lateral view young shell. Spring- vale -----	221
6. <i>Cypræa caroniensis</i> , n. sp. Springvale-----	221

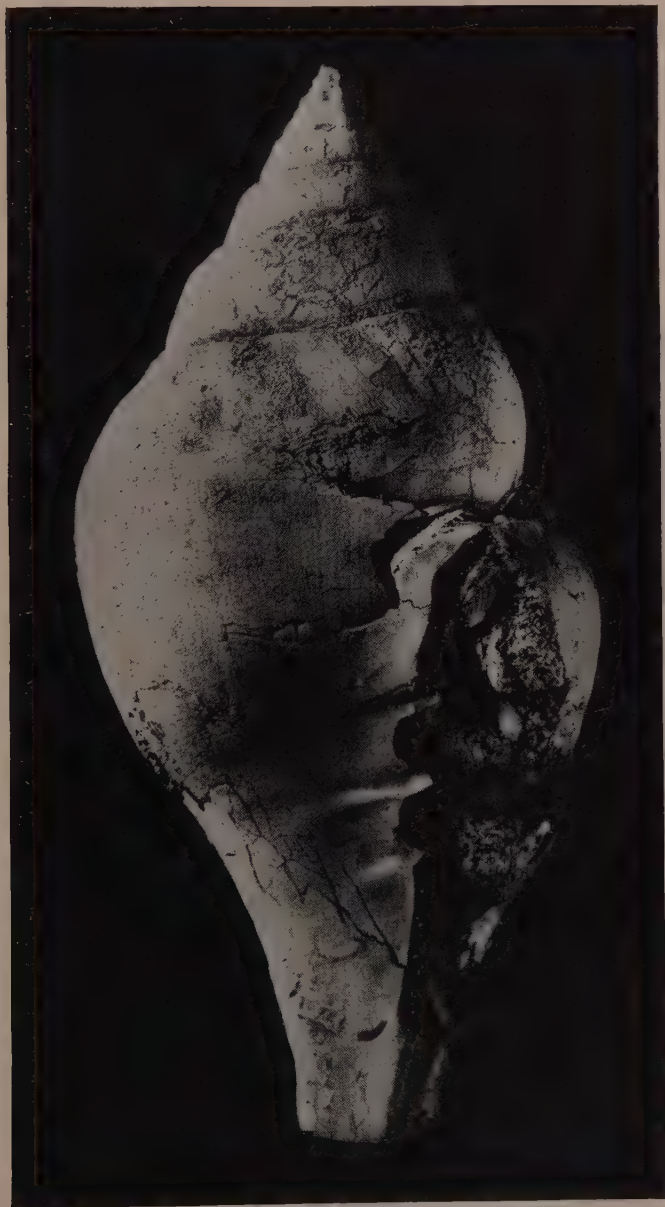


EXPLANATION OF PLATE 38

Figure

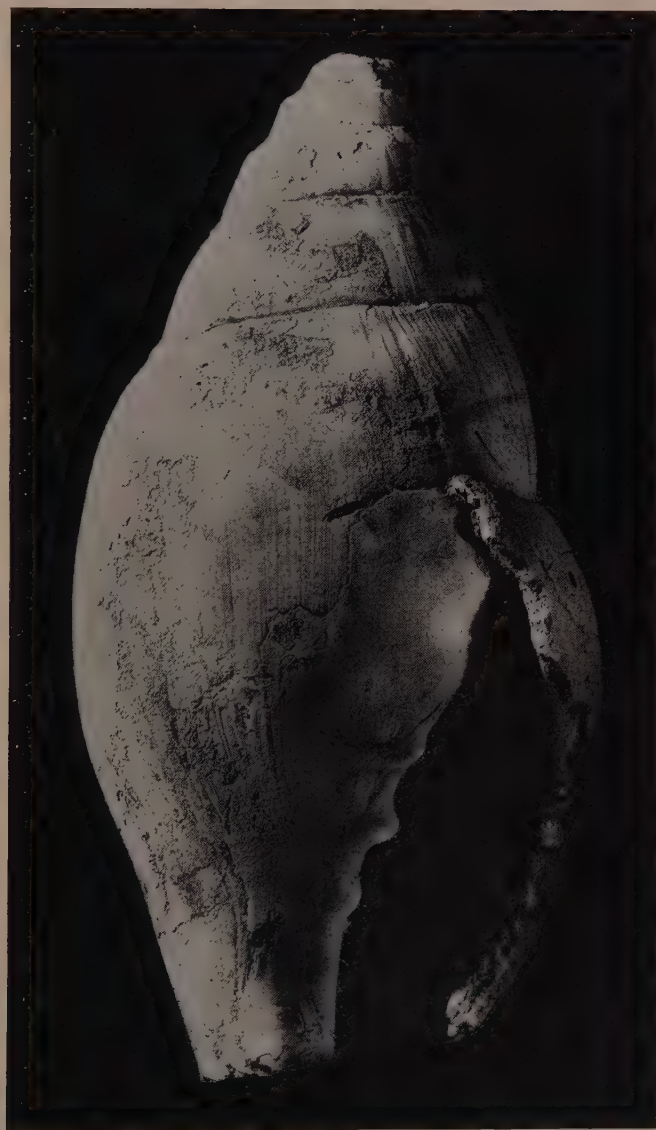
Page

1. *Xancus præovoides* Maury. Height 180 mm. Springvale-- 207



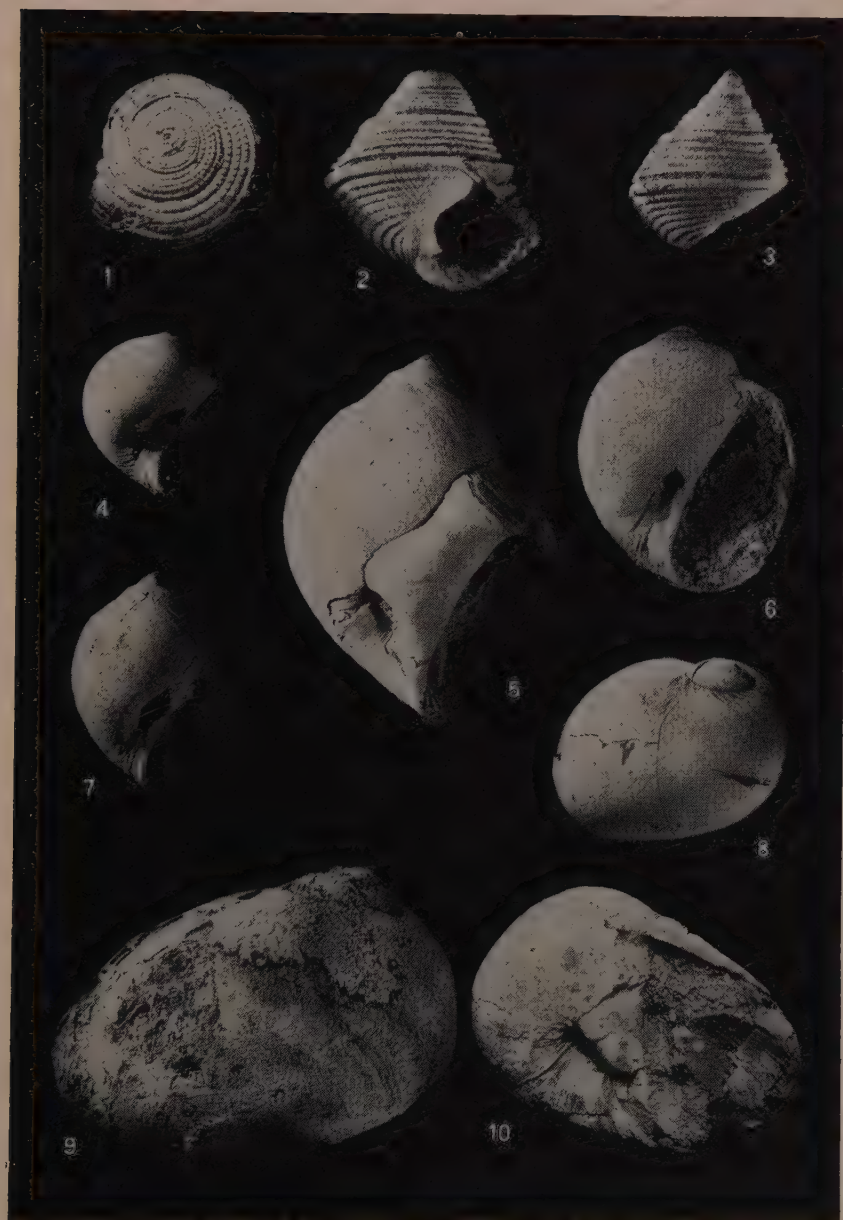
EXPLANATION OF PLATE 39

Figure	Page
1. <i>Xancus trinitatis</i> , n. sp. Height 170 mm. Springvale-----	208



EXPLANATION OF PLATE 40

Figure	Page
1. <i>Architectonica granulata</i> Lamarck. Springvale.....	236
2. <i>Modulus tamanensis</i> , n. sp. Height 18 mm. 13th mile post on Guaico-Tamana road.....	237
3. <i>Modulus tamanensis</i> , n. sp. Height 14 mm. 13th mile post on Guaico-Tamana road.....	237
4. <i>Natica youngi</i> Maury. Springvale.....	239
5. <i>Polinices caparona</i> , n. sp. 11th mile post on Caparo road...	240
6. <i>Polinices springvalensis</i> , n. sp. Springvale.....	241
7. <i>Polinices stanislav-meunieri</i> Maury. Springvale.....	240
8. <i>Natica canrena</i> (Linnæus) Moersch. Springvale.....	238
9. <i>Natica cuspidata</i> Guppy. Springvale.....	239
10. <i>Natica cuspidata</i> Guppy, Springvale. Guppy's collection...	239



EXPLANATION OF PLATE 41

Figure		Page
1.	<i>Serpulorbis</i> (<i>Vermicularia</i>) cf. <i>radicula</i> Stimpson. Spring- vale -----	228
2.	<i>Petalocochnus sculpturatus</i> var. <i>domingensis</i> Sowerby. Springvale -----	226
3.	<i>Serpulorbis decussata</i> Gmelin. Matura -----	224
4.	<i>Petalocochnus sculpturatus</i> var. <i>domingensis</i> Sowerby. Springvale -----	226
5.	<i>Pyrula carbasea</i> Guppy. Springvale -----	224
6.	<i>Vermicularia spirata</i> var. <i>trilineata</i> Guppy. 14 mm. Matura -----	228
7.	<i>Petalocochnus sculpturatus</i> var. <i>domingensis</i> Sowerby. Springvale -----	226
8.	<i>Epitonium</i> ? <i>leroyi</i> Guppy. Springvale -----	241
9.	<i>Pyrula trinitaria</i> , n. sp. Sculpture. Springvale -----	222
10.	<i>Clava venada</i> , n. sp. 30 mm. Brasso Venada Ravine -----	222
11.	<i>Epitonium</i> ? <i>leroyi</i> Guppy. Springvale -----	241
12.	<i>Pyrula trinitaria</i> , n. sp. Springvale -----	222
13.	<i>Vermicularia spirata</i> Philippi. Recent. Florida -----	227



EXPLANATION OF PLATE 42

Figure		Page
1.	<i>Turritella caparonis</i> , n. sp. 13th mile post on Guaico-Tamana road -----	234
2.	<i>Turritella caparonis</i> , n. sp. Machapoorie quarry -----	234
3.	<i>Turritella altilira</i> var. <i>tornata</i> Guppy. Height 27 mm. Brasso Junction. Typical form -----	230
4.	<i>Turritella altilira</i> var. <i>tornata</i> Guppy. Fragment near apex. Height 26 mm. Brasso Creek -----	230
5.	<i>Turritella altilira</i> var. <i>tornata</i> Guppy. Height 27 mm. Brasso Creek -----	230
6.	<i>Turritella planigyrate</i> Guppy. Springvale -----	232
7.	<i>Turritella planigyrate</i> Guppy. Springvale -----	232
8.	<i>Turritella planigyrate</i> Guppy. Springvale -----	232
9.	<i>Turritella variegata</i> var. <i>meta</i> Reeve. Recent. Gulf of Paria -----	
10.	<i>Turritella trinitaria</i> , n. sp. Springvale -----	230
11.	<i>Turritella machapoorensis</i> , n. sp. Machapoorie quarry -----	234
12.	<i>Turritella gatunensis</i> Conrad. Brasso Creek -----	229
13.	<i>Turritella cartagensis</i> Pilsbry and Brown. 11th mile post on Caparo road -----	233



EXPLANATION OF PLATE 43

Figure	Page
1. <i>Fissuridea alternata</i> Say. Length 13 mm. Matura-----	249
2. <i>Calyptrea centralis</i> Conrad. Diameter 14 mm. Matura-----	243
3. <i>Teinostoma caroniense</i> , n. sp. Diameter 4.5 mm. Springvale-----	249
4. <i>Teinostoma caroniense</i> , n. sp. Showing basal callus. Diameter 4 mm. Springvale-----	249
5. <i>Calliostoma decipiens</i> var. <i>laticarinatum</i> Guppy. Altitude 12 mm. Matura-----	245
6. <i>Calliostoma olssoni</i> , n. sp. Diameter 13 mm. Matura-----	247
7. <i>Solariella caroniana</i> , n. sp. Height 5 mm. Base of shell. Springvale-----	248
8. <i>Calliostoma caronianum</i> , n. sp. Height 18 mm. Springvale--	245
9. <i>Calliostoma decipiens</i> Guppy. Height 13 mm. Matura-----	244
10. <i>Calliostoma decipiens</i> var. <i>laticarinatum</i> Guppy. Diameter 14 mm. Showing base. Matura-----	245
11. <i>Calliostoma plicomphalus</i> Guppy. Alt. 22 mm. Matura-----	246
12. <i>Solariella caroniana</i> , n. sp. Height 5 mm. Springvale-----	248
13. <i>Calliostoma plicomphalus</i> Guppy. Diameter 14 mm. Base. Matura-----	246
14. <i>Calliostoma olssoni</i> , n. sp. Base. Young shell. Diameter 7 mm. Matura-----	247
15. <i>Calliostoma plicomphalus</i> Guppy. Alt. 13 mm. Matura-----	246



INDEX TO VOLUME X

Figures refer to the consecutive plate and page numbering of the volume not of the separate bulletins.

		Plate	Page			Plate	Page
A				Arca confugium			
Acheilus levisensis	-----	5	43	couvæ	-----	18	205
Aclis teres	-----		367	cumanensis	-----	16	222
Acrothele pretiosa	-----		62	cunearcopsis	-----	19	214
polita	-----	10	97	dariensis	-----	17	207
scarabeus	-----	10	98	deshayesi	-----	15	201
Aenigmatocystis brisa	---	9	91	esperanza	-----	17	216
Agnostus gladiator	-----	5	36	filicata	-----	19	220
innocens	-----	5	35	fontinalis	-----	17	207
janei	-----	5	37	halidonata	-----	16	200
Alectrion brassica	-----	7	362	henekeni	-----	17	205
Amusium papyraceum	---		241	var. trinidadensis	-----	18	206
rex-maris	-----	26	242	inaequilateralis	-----	17	208
Ancilla brassica	-----	44	351	incongrua	-----	18	218
caroniana	-----	44	350	manzanillæ	-----	19	193
lamellata	-----	44	349	maturensis	-----	16, 17	230
Anomalcardia brasiliana	---	40	317	mayensis	-----	16	192
Anomalograptus reliquus	---	7	82	milifilia var. latrini-			
Anomia simplex	-----	23	244	dadis	-----	19	196
umbonata	-----		244	mundonuevensis	-----	16	188
Apatokephaloides inflatus	---		45	occidentalis	-----	12	186
Arca auriculata	-----	15	201	oropuchensis	-----	15	215
balboæ	-----		217	patricia	-----	13	209
billingsiana	-----	17	228	pat. var. waringi	-----	14	210
var. schultzana	-----	16	229	perinopinata	-----	17	198
brasiliana	-----	15	218	pittieri var. narioana	-----	19	225
brassica	-----	19	208	pointnoirensis	-----	19	213
brightonensis	-----	18	228	prometoriana	-----	11	213
campechensis	-----		18	reticulata	-----	19	195
candida	-----	19	194	sancti-andreæ	-----	16	219
centrota	-----	19	190	secticostata	-----	12	199
chemnitz	-----		220	sheldoniana	-----	19	191
chemnitzoides	-----		221	tabaquita	-----	19	224
chiriquiensis	-----	13	211	tab. var. molesta	-----	18	224
var. carolinoides	-----	13	212	tectum-columbæ	-----	18	204
var. stamineopsis	-----	13	212	thauuma	-----	12	214

BULL. AMER. PALEONT.

	Plate	Page		Plate	Page
Arca tolepiea		227	Cardium couvense	34	280
transversa var. sancti-			inconspicuum		276
davidia	17	216	isocardia	33	277
trinitaris	14	187	lingula-leonis	34	278
umbonata	14, 19	187	machapoorensis	34	283
Architectonica granulata	51	388	manzanillense	34	285
B			maturensis	34	287
Barbatia		193	medium	34	283
Bayfieldia finkelnburgi	6	50	spinosum		289
tumifrons	6	49	merandesne	34	287
Bienvillea corax		38	muricatum	33	279
Beekmantown boulders,			perii-maris	34	288
fauna of		54	sancti-davidis	33	281
Benthonella turbinata		389	semisulcatum		290
Blountia piluloides	11	111	serrantense	34	283
Boeckia descensus	11	109	tamanense	33	281
Borsonia varicosa	45	344	venadense	34	282
Botula cinnamomea		246	Carinaria caperata		334
Boulders, register of		116	Cedros Point fauna		170
Burlingidae		52	Cerithium harrisi		364
Bursa crassa		369	isabellæ		365
C			tinkeri		365
Cadulus parianus		334	Chama involuta	40	320
Calamograptus porrectus	7	79	Chione cancellata	39	305
Calliostoma caronianum	54	397	caroniana	40	315
decipiens	54	396	dalliana	39	308
var. laticarinatum	54	397	var. guppyana	39	310
olssoni	54	399	var. veatchiana	39	309
plicomphalus	54	398	latrilirata	40	313
Calloarca		194	pectorina	39	316
Callocardia gatunensis	38	298	portesiana	39	307
Calyptræa centralis	54	395	var. beaulti	39	307
Cambrian boulders in Levis			pubera	40	312
conglomerate		29	riomaturensis	40	314
Cancellaria epistomifera	46	345	sancti-davidis	37	313
montserratisensis	46	346	subrostrata		306
Cardita guppyi		322	walli	39	311
virginiae		322	Clark, Thos. H., author of		
Carditopsis		324	Bull. 41		21
Cardium antillarum	34	286	Clava venada	52	374
bowdenense		280	Clementia dariena	37	293
carolinæ		288	Clementia ? tæniosa		295
caroniense	33	276	Cumbella asphaltoda		363
castum	34	284	inflata var. brassica	47	363
var. brassicum	34	285	labreana		363
			Conodonts		84

INDEX, VOL. X

	Plate	Page
<i>Conularia pristina</i> -----	10	102
<i>Conus burckhardtii</i> -----	45	339
<i>planiliratus</i> -----	45	338
<i>stenostoma</i> -----	45	337
<i>cf. williamgabbii</i> -----		337
<i>Corbiucula caroniana</i> -----	41	326
<i>comparana</i> -----	41	325
<i>coubarillia</i> -----	41	326
<i>Corbula arionis</i> -----	30	263
<i>brassensis</i> -----	31	259
<i>caribea</i> -----	31	254
<i>var. pergrata</i> -----	31	255
<i>cistellula</i> -----	30	262
<i>daphnis</i> -----	31	256
<i>dianæ</i> -----	30	264
<i>guaiconensis</i> -----	30	262
<i>helenæ</i> -----	31	260
<i>heterogenea</i> -----		251
<i>hexagonella</i> -----	31	258
<i>isla-trinitatis</i> -----	30	253
<i>manzanillensis</i> -----	31	257
<i>sancti-andrææ</i> -----	30	252
<i>sancti-dominici</i> -----	30	250
<i>siricea</i> -----		257
<i>smithiana</i> -----	31	261
<i>vieta</i> -----	30	249
<i>viminea</i> -----	30	260
<i>Costa Rica forams</i> -----		1
<i>Crassatellites montserratensis</i> -----	42	328
<i>trinitarius</i> -----	42	327
<i>Crassinella cahuitensis</i> -----	2	12
<i>guadalupensis</i> -----	42	329
<i>guppyi</i> -----	42	329
<i>martinicensis</i> -----	42	330
<i>Crepidula aculeata</i> -----		395
<i>fornicata</i> -----		396
<i>Crenella divaricata</i> -----	29	247
<i>Cristellaria reniformis</i> -----	1	7
<i>cultrata</i> -----	1	7
<i>Cyanocyclus</i> -----		325
<i>Cyathodonta</i> -----		330
<i>Cyclinella cyclica</i> -----	37	303
<i>Cymia brightonensis</i> -----		367
<i>Cypræa caroniensis</i> -----	48	373
<i>henekeni</i> -----	48	371
<i>var. lacrimula</i> -----	48	372

	Plate	Page
D		
Denisis eminens_____	5	41
pusillus_____	5	42
Dichograptus tenuis_____	7	82
Dikelokephalina broggeri_____	6	47
Dillwynella errata_____		399
Distortrix simillima_____		368
Ditrupa_____		334
Donax couvana_____	31	268
fabagelloides_____		267
striata_____		268
Dosinia concentrica_____	36	293
titan_____	35, 36	291
Drillia sp._____	2	11
belahubbardi_____		341
consors_____	2	11
consors_____	43	342
henekeni_____	43	340
var. caroniana_____	43	341
manzanillica_____	43	342
vaningeni var. mach- apooensis_____	43	343
var. sancti-andreae_____	43	343
E		
Echinochama yaquensis_____		321
Eoorthis baddeleyi_____	10	101
bayfieldi_____	10	100
biggsbyi_____	10	101
Epitonium ? leroyi_____	52	393
pseudoleroyi_____		394
tamanensis_____	48	394
Erycinella guppyi_____	38	324
Eunoa vicina_____	10	99
Eulima egregia_____	46	367
F		
Farallon Rock_____		160
Fissuridea alternata_____	54	401
Flora. Trinidad Miocene_____		166
Fronicularia alata_____	1	8
Fusus springvalensis_____	46	358
G		
Glycymeris acuticostatus_____	2	11
var. guaica_____	29	184
canalis_____	29	183
var. trinitensis_____	29	183

BULL. AMER. PALEONT.

	Plate	Page		Plate	Page
Glycymeris decussata	29	182	Marginella couviana	45	354
jamaicensis var. mach-			dalliana		353
apooensis	29	182	guaica	45	352
mendozaana	29	185	maia	45	353
trilobocostata	29	184	solitaria		353
Godineau River Miocene		164	springvalensis	45	352
H			Maury, C. J., author of		
Hemisinus comparanus	46	387	Bull. 42		153
fauna		170	Melanella egregia	46	367
Hyria trinitaria	24	235	Melongena consors	46	360
L			Menomonidæ		51
Leda egregia		180	Metis trinitaria	33	273
guppyi	23	174	Mitra henekeni	46	354
illecta	23	174	longa		355
jamaicensis		179	var. couvasensis	46	355
montserratensis	23	176	sancti-francisci	46	356
packeri		176	Modiolus brassoensis	23	246
patagonica		180	waringi	28	245
peltella		175	Modulus tamanensis	51	389
perlepida	23	178	Murex cornurectus		365
vitrea		179	Mytilus caroniensis	23	245
Leiocoryphe gemma	5	39	N		
westoni	11	110	Natica canrena	51	390
Leptella exigua	10	102	cuspidata	51	391
Leptobolus incultus	10	95	perlineata		392
Levis shales, fauna of		63	youngi	51	391
Lingulella ellsi		62	Nodosaria	1	5
raymondi	10	94	soluta	1	6
Linnarssonella zoar	10	98	Norwoodiæ		52
List of species from Upper			Nucula baccata	23	172
Cambrian boulders		31	crosbyi		173
Loganellus billingsi	5	38	schömburgki		171
Lucinisea		319	vieta		173
M			Nummulites costaricensis	1	9
Macrocallista maculata	36	297	O		
Mactra alata	32	265	Oliva cercadica		348
macescens	32	265	couvana	44	347
sancti-blasii	32	266	cylindrica	44	347
Malea camura	47	370	trinidadensis		348
var. elliptica		370	Olivella mutica	44	349
Marginella arcuata		354	Orbitolites oregonensis	2	13
calypsonis	45	351	Oregon, Orbitolites of		13
			Osceolia brevifrons	6	48

INDEX, VOL. X

	Plate	Page		Plate	Page
<i>Ostrea haitensis</i> -----	20	230	<i>Prioniodus pamphagus</i> ---	8	88
<i>messor</i> -----	21	233	<i>theron</i> -----	8	85
<i>var. caimitica</i> -----	22	234	<i>tigris</i> -----	8	87
<i>var. tabaquita</i> 22, 23	234		<i>Pulvinulina menardii</i> ----	1	9
<i>puelchana</i> -----	21, 22, 23	231	<i>Pyrula carbacea</i> -----	52	376
<i>virginica</i> -----	232		<i>trinitaria</i> -----	52	374
P			R		
<i>Paterula westoni</i> -----	10	96	<i>Raymondia respecta</i> -----	6	53
<i>Pecten archon</i> -----	27	236	<i>Raymondidæ</i> -----		52
<i>cf. cercadica</i> -----	27	239	<i>Rissoa pariana</i> -----		389
<i>var. tabaquita</i> -----	25	240	S		
<i>demiurgus</i> -----	25, 27	237	<i>Salterella</i> -----		24
<i>gibbus</i> -----	25, 27	238	<i>conulata</i> -----	4	26
<i>kunkuma</i> -----		240	<i>Sanguinolaria unioides</i> ---		269
<i>maturensis</i> -----	25	241	<i>Scala leroyi</i> -----	52	393
<i>vaughani</i> -----	240		<i>Scambula</i> -----		327
<i>Peronopsis barrandi</i> -----	11	103	<i>Schumardia granulosa</i> ----	11	106
<i>marcoui</i> -----	11	105	<i>Scobinella morierei</i> -----	45	345
<i>Petalochonchus sculptura-</i>			<i>Seleneceme propinqua</i> ----	11	108
<i>tus var. domingensis</i> ----	52	378	<i>Semele claytoni var. cou-</i>		
<i>Petricola caroniana</i> -----	31	274	<i>vensis</i> -----	32	270
<i>Phacoides actinus var. us-</i>			<i>proficua</i> -----	32	269
<i>carensis</i> -----	2	12	<i>purpurascens</i> -----	31	269
<i>roigi</i> -----	40	319	<i>Serpulites conflexus</i> -----	9	88
<i>Phos cf. erectus</i> -----		362	<i>Serpulorbis decussata</i> ----	52	376
<i>Pholadomya sawkinsi</i> -----	42	333	<i>papulosa</i> -----		377
<i>walli</i> -----	42	332	<i>Sillery formation, fauna of</i>		60
<i>Pitaria catharinæ</i> -----	38	300	<i>Solariella caroniana</i> -----	54	400
<i>circinata</i> -----	38	301	<i>semidecussata</i> -----		400
<i>var. juncea</i> -----	38	302	<i>Solarium granulatatum</i> ----	51	388
<i>dione</i> -----	38	301	<i>Soldado formation</i> -----		159
<i>fulminata</i> -----	38	299	<i>Solen obliquus</i> -----	29	267
<i>labreana</i> -----	38	303	<i>Solenopleura trunca</i> -----	6	44
<i>Platycolpus marcoui</i> -----	6	48	<i>Solenosteira cochlearis</i> ----	47	362
<i>Plethagnostus gyps</i> -----	5	34	<i>semiglobosa</i> -----	47	361
<i>Pleurotoma</i> -----		339	<i>Stenopilus intermedius</i> ----	5	40
<i>Plicatula gibbosa</i> -----	22	243	<i>Strigilla pisiformis</i> -----	31	272
<i>Pliocene of Trinidad</i> -----		169	<i>Strombina guaica</i> -----	47	364
<i>Plumulites mobergi</i> -----	11	115	<i>Strombus bifrons</i> -----	47	373
<i>Polinices caparona</i> -----	51	392	<i>Symphysurus elongatus</i> ----		111
<i>springvalensis</i> -----	51	393	<i>Syntrophia elax</i> -----	5	33
<i>stanislas-meunieri</i> -----	51	392	T		
<i>Polygnathus argos</i> -----	8	88	<i>Teinostoma caroniense</i> ----	54	401
<i>Prioniodus dorceus</i> -----	8	86	<i>Telephus</i> -----		112
<i>lelaps</i> -----	8	87			
<i>melampus</i> -----	8	86			

BULL. AMER. PALEONT.

	Plate	Page		Plate	Page
Tellina caroniana	31	271	Turritella altilira var. tor-		
waringi	31	271	nata	53	382
Terebra sp.	2	11	caparonis	53	386
bipartita	43	335	cartagenensis	53	385
isaacpetiti		336	gatunensis	53	381
petiti		336	machapoorensis	53	386
sulcifera	43	334	planigyrate	53	384
Teredo incrassata	29	248	trinitaria	53	382
Tetragraptus echinatus	7	83	Typhis alatus var. obesus	47	366
Thracia meridionalis	42	331	linguiferus	47	366
semirugosa		330			
Thyasira sancti-andreae	41	318	V		
Timoclea		316	Vaginulina legumen	1	6
Tivela austeniana	38	296	VanWinkle (Palmer), au-		
var. maturensis	38	296	thor of Bull. 40		1
mactroides	37, 38	295	Vermicularia cf. radícula	52	380
Triarthrus angelinii		110	spirata	52	379
belli		110	var. trilineata	52	380
Triloculina tricarinata	1	11	Venericardia terryi var.		
Turbonilla octona		368	brassica	41	323
plastica		368	trinidadensis	41	323
Turricula bristoli	46	357	X		
Turris albida	43	339	Xancus praevoideus	49	359
var. sancti-davidis	43	340	trinitatis	50	360

END OF VOL. X

